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The **RUBBER AGE**

VOL. 48, No. 2 **NOVEMBER, 1940**

Determination of Scorching of Rubber and Synthetic Compounds by Use of the Mooney Plastometer

BY JOHN V. WEAVER

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Raybestos-Manhattan, Inc.
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A quick, reliable test for the determination of the scorching characteristics of unvulcanized rubber and synthetic compounds is described. The change in plasticity, at constant intervals of time, is measured by means of the Mooney Plastometer at a temperature of 250° F. When vulcanization begins, the plasticity increases. The time, at which the plasticity reading reaches 100, is taken as the scorching point. Ten or twelve minutes is usually sufficient to determine whether or not a compound is likely to cause scorching troubles in factory processing.

SCORCHING has been one of the rubber compounder's foremost troubles for many years. It is true that before the use of organic accelerators, this trouble was practically unknown, inorganic accelerators such as magnesia and litharge causing little scorching difficulties. However, when the use of organic accelerators was ushered in, like every new development, troubles were encountered. Since the rate of cure was stepped up, the time and temperature necessary for vulcanization were decreased, and consequently the man at the mill, calender, or tube machine began to report burning troubles. Present day compounding technique and precautions have eliminated a considerable amount of scorching; however, the modern demand for faster curing compounds and the improved physical characteristics obtained by the use of fast accelerator combinations have left the compounder not entirely free from scorching difficulties.

When a compound partially vulcanizes during the processing operations or in bin storage, it is not only costly because of the loss of materials and labor involved but also because of the loss of time required to reprocess the compound or to change it to insure safety in handling. It is, therefore, of great value to the compounder to have some method of studying the scorching characteristics of a compound, to determine its safety in processing, before it is released for factory use. This paper is written with the idea of presenting a quick and reliable method of determining the scorching characteristics of rubber and synthetic compounds by the use of the Mooney plastometer *(1)*.

The Mooney plastometer is familiar to the rubber compounder as an instrument for determining the plasticity of crude rubber, synthetics, and unvulcanized compounds; however, little has been mentioned of its use as an instrument for studying scorching characteristics.

Note: This paper was awarded First Prize in the 1940 Essay Contest sponsored by the New York Group, Rubber Division, A.C.S., and was presented at the October 18, 1940, meeting of that Group.

(1) This instrument was developed by Melvin Mooney of the United States Rubber Co. He refers to it as a "shearing disk plastometer." See *Ind. Eng. Chem. Anal. Ed.*, **6**, pp. 147-51 (1934).

The Mooney plastometer, as used for running scorch tests, is equipped with platen thermometers having a range up to 260°F. instead of those on the ordinary machine which have a range of about 220°F. It consists essentially of two electrically-heated platens, the top one being movable and having a lever closing device. There is a circular cavity with a knurled surface within the platens. Inside of the cavity is a removable, rotating disk which also has a knurled surface, the knurling in both cases being to prevent slipping. The disk is fastened to a vertical shaft which fits into a spindle carrying a worm gear. This worm gear engages another worm gear fastened to a rotating horizontal shaft. This shaft is free to move longitudinally. One end of the free moving shaft rides against a calibrated spring; the other end against a dial indicator. A toothed reduction gear drive wheel, mounted to the end of the free moving shaft, is free to move in a horizontal direction along an engaging pinion on the drive shaft from a synchronous A.C. motor.

When the resistance to the rotating disk increases or decreases, because of a change in plasticity in the sample, the increase or decrease in torque is transmitted to the free moving shaft and causes it to move either one way or the other, the movement being measured by the dial indicator. The spring on one end of the free moving shaft is adjusted so that when the plastometer is run empty, the dial indicator reads zero. When the plasticity of the sample has increased sufficiently to cause a dial reading of 100, the test is complete. The time required to reach this reading is considered the scorching time. In rare cases a very stiff compound shows an initial plasticity reading of 100 or more, in which case the test is continued until a reading of 150 is reached.

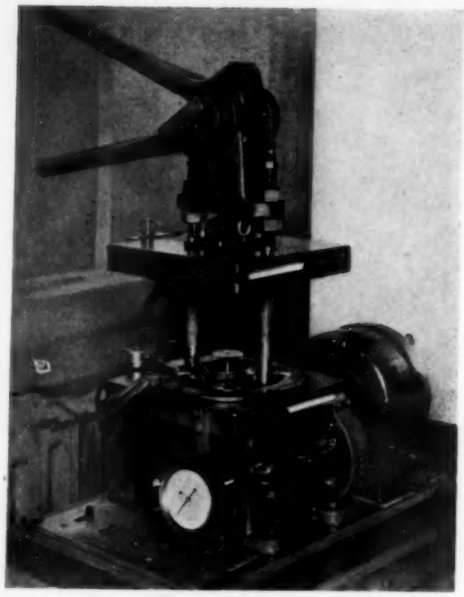
The speed of the rotating disk is only 2 r.p.m. and is constant, being driven by a synchronous motor. Therefore, when readings are taken at constant intervals of one minute, the disk is always in the same position.

Method of Running Scorch Tests

In running scorch tests, the plastometer is first closed and the platens heated to 250°F. (the temperature chosen for the determination of scorching). When the thermometers show that each platen has reached 250°F., the machine is opened and a piece of the sample to be tested, about ¼-inch to ⅜-inch thick and 2 inches square, is placed in the cavity, both above and underneath the rotating disk. Samples of this size allow plenty for overflow from the cavity. The top platen is then lowered and the sample allowed to heat for one minute, after which time the electric motor is started and the disk begins rotating within the cavity in the platens, causing a very slow churning action of the sample. When the motor is started, the reading on the dial is recorded, and readings are taken every minute thereafter until a recording of 100 is reached. A stop watch is used to record the time. In order to obtain a graphic picture of the scorching test, plastometer readings are plotted against time.

Discussion of Results

Since this method of determining the scorching of rubber and synthetic compounds is based entirely upon the measurement of the change in plasticity at constant intervals of heating at a certain temperature, the picture of what happens is best seen in the form of a curve made by plotting the plasticity reading against the time. In an effort to bring out the value of this test as a means for studying the scorching characteristics of various compounds, several typical illustrations are discussed.



The Mooney Plastometer

In the work presented here, a temperature of 250°F. was chosen as a standard temperature for running the Mooney scorch tests. This temperature was selected, since it seems to most nearly approach the temperatures encountered in mixing, extruding, and other factory processing operations, and also because 250°F. is not considered a very active curing temperature for most accelerators. As will be shown further in this report, if the temperature chosen is too high or too low, the effectualness of the test may be lost.

(1) The Use of the Mooney Plastometer as a Means of Determining the Scorching Effect of Accelerator Combinations and the Effect of a Retarder

Many desirable physical properties, such as good cold flow and good resilience, are obtained by using combinations of accelerators, that is, the use of one accelerator to activate another; however, such combinations are oftentimes dangerous in that they cannot be safely handled in the factory without scorching. The Mooney plastometer here lends a helping hand. The compounder may study the scorching effect of various accelerators and accelerator combinations before he releases the stock for factory use. An interesting illustration of this is shown on Curve Sheet No. 1:

Compound (A), an activated compound, from time to time caused trouble because of scorching. A change was therefore made in this stock in order to increase its safety in handling. The change was made by adding a retarder (salicylic acid) to Compound (A). This change eliminated the scorching difficulties and at the same time did not, to any extent, alter the physical properties.

Now let us see how this change is shown by the Mooney plastometer scorch test: Compound (A), as shown by Curve (A) on Curve Sheet No. 1, attained a plasticity reading of 100, which is considered the scorching point, in a little over 17 minutes. The plasticity decreased slowly for about 9 minutes, ran constant for 3 minutes, and then slowly began to increase. At 14 minutes the rise became steeper and finally curved sharply upward to a reading of 100 after 17 minutes. This curve shows that Compound (A) does not begin to show signs of cure until about 11 minutes and then sets up slowly for about 3 or 4 minutes, after which time the scorching point is quickly reached.

Let us now examine Curve (B) representing Compound (B): Here we find the plasticity decreasing slowly for about 17 minutes and then running constant for about 8 minutes, after which time it increases slowly for 9 minutes and then increases rather rapidly, although not as abruptly as (A), to the scorching point after 40.5 minutes. The difference in scorching characteristics of these two compounds is clearly brought out by the Mooney plastometer scorch test. Compound (A), as shown by Curve (A), scorches at 250°F. in about 17 minutes, while Compound (B) does not reach the scorching point until 40.5 minutes; in other words, (B) takes nearly 2½ times as long as (A) to scorch at 250°F. After one has become familiar with the Mooney scorch test, he will know by glancing at the curve sheet that Compound (B) is considerably safer to handle in the factory than Compound (A). Experience has shown that a compound, in general, scorching in less than 10 to 12 minutes at 250°F. is apt to cause burning difficulties, the susceptibility to scorching increasing as the time decreases.

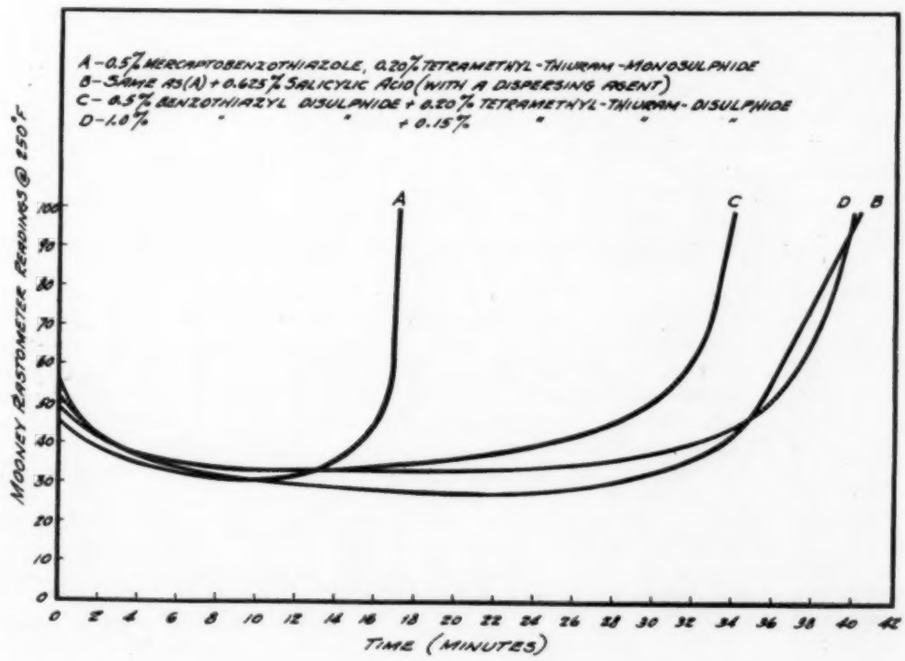
It is not, however, always true that a compound scorching in less than 10 to 12 minutes at 250°F. will cause trouble, for some compounds scorching in as short a time as 8 minutes at 250°F. are used every day without much difficulty, if precautions are taken. On the other hand, a compound may have a scorching time longer than 12 minutes at 250°F. and yet cause trouble in factory processing because of burning. Compound (A) is an example of this. Although this stock requires 17 minutes at 250°F. to scorch, it sometimes causes trouble. This may be explained, however, by the fact that this particular compound is extruded and the trim is re-milled and again extruded. This excessive amount of mastication at elevated temperatures causes scorching. In cases such as the one just cited, it may be necessary to establish a safety scorching time at 250°F. greater than 12 minutes in order to be entirely assured of freedom from scorching.

Compounds (C) and (D) on Curve Sheet No. 1 show another means of converting Compound (A) over to a safe handling stock. This is accomplished by a change in accelerators instead of by the use of a

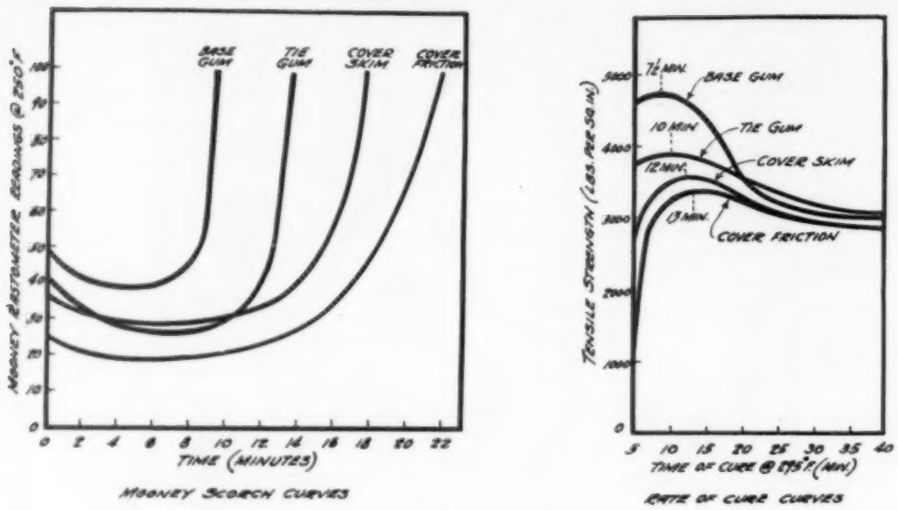
A Comparison of the Mooney Plastometer Scorch Test @ 250° F. vs. a Press Cure Scorch Test @ 220° F.

	Press Cure Scorch Test @ 220° F.			
	Compound A	Compound B	Compound C	Compound D
75 Min.	Uncured	Uncured	Uncured	Uncured
90 Min.	Slight Cure	Uncured	Uncured	Uncured
105 Min.	Slight Cure	Uncured	Uncured	Uncured
120 Min.	Cured	Uncured	Slight Cure	Uncured
135 Min.		Slight Cure	Cured	Slight Cure
150 Min.		Slight Cure		Slight Cure
165 Min.		Slight Cure		Slight Cure
180 Min.		Cured		Cured
	Mooney Scorch Test @ 250° F.			
	Compound A	Compound B	Compound C	Compound D
Scorched in	17.2 Min.	40.5 Min.	34 Min.	40 Min.

Note: The Compounds referred to in this table are the same as those shown on Curve Sheet No. 1.


A-0.5% MERCAPTOBENZOTHIAZOLE, 0.20% TETRAMETHYL-THIURAM-MONOSULPHIDE
B-SAME AS (A) + 0.625% SALICYLIC ACID (WITH A DISPERSING AGENT)
C-0.5% BENZOTHIAZYL DISULPHIDE + 0.20% TETRAMETHYL-THIURAM-DISULPHIDE
D-1.0% " " + 0.15% " " "
MOONEY PLASTOMETER READINGS @ 250° F.
TIME (MINUTES)
A
C
D
B

Curve Sheet No. 1
Scorch Curves—Pure Gum Stocks



CURVE SHEET NO. 2

retarder. Compound (C) scorches in 34 minutes, while Compound (D), containing twice the amount of basic accelerator but less activation, does not scorch until 40 minutes. The effect of this change in acceleration on scorching is clearly indicated by the Mooney plastometer scorch curves.

The set of curves on Curve Sheet No. 1 would be valuable information to the compounder, since it would readily show him the increased safety from scorching obtained by making some small changes in compounding.

In order to compare this method of determining scorch with some other method, a comparison has been made with the method of press curing slabs of a compound for different periods of time at 220°F. and examining them for degree of cure. This data is tabulated in the accompanying table. The compounds compared are the same as those previously discussed and shown on Curve Sheet No. 1. It is interesting to note that the Mooney scorch test gives results which fall in line with those shown by the press cure scorch test at 220°F. In the press cure test, Compound (A) cures in 120 minutes at 220°F; (B) cures in 180 minutes; (C) cures in 135 minutes; and (D) in 180 minutes. These results compare favorably with the Mooney scorch tests which show (A) to scorch in a little more than 17 minutes at 250°F; (B) 40.5 minutes; (C) 34 minutes, and (D) 40 minutes.

These two sets of results, although from different methods and at different temperatures, are in about the same order of magnitude, both clearly showing the four compounds to scorch in the following order: (A), (C), (D), and (B). The Mooney plastometer test, however, is a more rapid and more convenient method for determining scorch characteristics. The results can also be interpreted more easily, since a glance at the scorch curves readily gives a complete picture of the susceptibility to scorching.

This first illustration shows the value of the Mooney plastometer scorch test to the compounder in determining just what types of acceleration are apt to cause scorching troubles, and it gives a clear cut picture of both the effect of accelerator changes and of the use of a retarder on the scorching characteristics of a rubber compound.

In discussing the compounds in the above illustration, very little stress has been laid upon the accelerator compositions and changes, since this paper deals with a method of testing rather than of compounding. It might, however, be interesting to know that the physical properties of each of the compounds just discussed have been approximately the same.

(2) The Relationship of Scorching (as Shown by the Mooney Plastometer) to the Rate of Cure

The compounds of a V-belt furnish one with some interesting data on the rate of cure, and in this discussion it has been attempted to find the relationship between scorching and the rate of cure of these compounds. In an article such as a V-belt, composed of several compounds and having considerable thickness, it is often necessary that the rate of cure of the different compounds be stepped somewhat so that the outside does not become over-cured before the center. This is shown by the rate of cure curves on Curve Sheet No. 2.

Beginning with the innermost part of a V-belt, we have the base gum which comprises the greatest part of the belt. One would, therefore, expect this compound to be the fastest curing, and this is true as shown by the rate of cure curves on Curve Sheet No. 2. The base gum reaches its optimum cure in 7.5 minutes at 295°F. The tie gum around the cords is found to be the next in rate of cure. It reaches its optimum cure in 10 minutes at 295°F. As we work our way outward in the V-belt construction, we find the cover skim next to the tie gum in rate of cure. This compound reaches its optimum cure in 12 minutes at 295°F. The cover friction, as would be expected, is the slowest curing, reaching its peak cure in 13 minutes at 295°F.

Now let us look at the Mooney scorch curves and see if there is any relationship between the rate of cure at 295°F. and the rate of scorch at 250°F. Glancing at the Mooney scorch curves, one immediately finds that there is, in this particular instance, a definite relationship between scorch and rate of cure. The base gum compound which was just pointed out as having the fastest rate of cure at 295°F. also scorches in the least time at 250°F. It reaches the scorching point in about 9.5 minutes. The tie gum which is second in rate of cure is also second in rate of scorch. It attained the scorching point in 13.5 minutes. The cover

skim is the third compound in the order of scorching just as it is third in rate of cure. It scorches in a little less than 18 minutes. The cover friction is last in reaching the scorching point and is also the slowest curing; it scorches in 22 minutes. This comparison of scorching time versus rate of cure is very interesting, the relationship in this instance being quite marked.

Let us now compare more closely the Mooney scorch curves of each compound with the corresponding rate of cure curves: The rate of cure curve for the base gum compound slopes slightly from the initial 5 minute cure to the peak cure at 7.5 minutes. This tends to show that the base gum is fast curing and reaches its optimum cure soon after vulcanization begins. This is also shown by the scorch curve. Here we see that the length of time between the first signs of cure and the scorch point is only about 3.5 minutes, the curve taking an abrupt sweep upward soon after vulcanization begins. The same relationship holds for each compound. The slope of the rate of cure curve, up to the optimum cure point for the tie gum compound, is slightly steeper than that of the base gum stock. This is shown equally as well by the Mooney scorch curve. The slope of the scorch curve from the point of the first indication of cure to the scorching point is less abrupt than the corresponding part of the scorch curve for the base gum. The time elapsed between these two points is about 5 minutes as compared to 3.5 minutes for the base gum compound.

This same comparison can be made for the cover skim and cover friction compounds. The slope of the rate of cure curve up to the optimum cure point of the cover skim compound is quite steep as compared with the corresponding slopes of the rate of cure curves of the base gum and tie gum compounds. The scorch curve of the cover skim shows a much less abrupt sweep from the point of first noticeable cure to the scorch point. The time elapsed between these points is about 9 minutes as compared to 3.5 and 5 minutes for the base gum and tie gum stocks. The rate of cure curve of the cover friction compound shows a steeper slope up to the point of optimum cure than the skim compound. The scorch curve of the cover friction shows the same relationship since the time between the point of first noticeable cure and the scorch point is approximately 13 minutes as compared to 9 minutes for the skim compound.

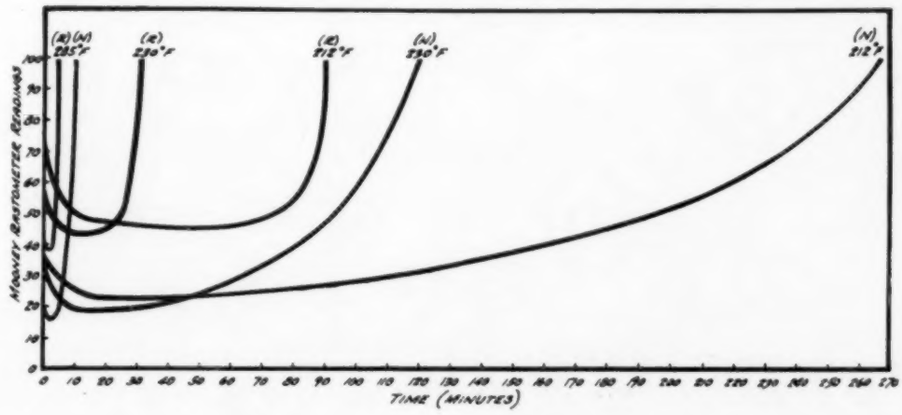
The comparison of the Mooney scorch curves and rate of cure curves of these V-belt compounds show some interesting facts. In this particular case one could visualize from the slope of scorch curves the approximate slope of the rate of cure curve up to the point of optimum cure. This has been shown by the preceding comparisons. For instance, in the case of the base gum compound, the time between the point of first detectable cure and the scorch point is small, being only 3.5 minutes. Upon examining the rate of cure curve up to the optimum point of cure, we find that it slopes very slightly. In the same way we could construct a picture of the approximate slope of the rate of cure curves up to the optimum cure point for the other compounds. The scorch curve of the cover friction shows a long lapse of time between the first detectable point of cure and the scorch point. One would, therefore, after making the foregoing comparisons, expect to find a steep sloping rate of cure curve from the initial curing time up to the optimum time of cure. This deduction is correct, as the curve sheet shows.

There is a relationship between the scorching characteristics and the rate of cure, which has been shown in the foregoing discussion. It is evident that one may draw some very helpful conclusions from these sets of curves; however, before one can make a generalized statement as to the relationship between the rate of scorch, as determined by the Mooney scorch test, and the rate of cure, a considerable amount of work is necessary, since various accelerator combinations might act differently and the temperature at which the rate of cure is determined might cause a variation in the relationship. An investigation of this relationship would no doubt bring out some very stimulating facts and would be worthy of recognition.

(3) The Mooney Scorch Test Run at Different Temperatures

Curve Sheet No. 3 shows the Mooney plastometer scorch curves of two compounds at different temperatures. Compound (N) is a soft neoprene compound; (R) is a rubber compound. The Mooney scorch test has been run at several different temperatures in order to show the effect of temperature on the scorching characteristics. Let us first discuss the scorching characteristics of these two compounds at a low temperature, represented by 212°F.

The curve sheet shows us that scorching at 212°F. takes place very slowly. The rubber compound (R) runs along at a constant plasticity for nearly 55 minutes and then increases fairly rapidly to the scorch point. The scorching time is a little over 90 minutes. The neoprene compound (N) runs along at a constant plasticity for about 40 minutes and then very grad-



CURVE SHEET NO. 3
Scorch Curves at Various Temperatures

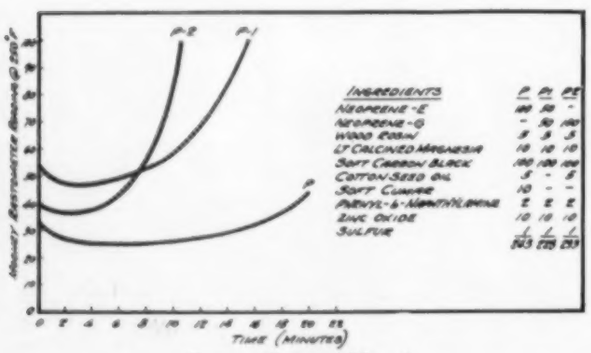
ually the plasticity increases until the scorching point is reached. The scorching time in this case is 268 minutes. At 212°F. one can readily see that the rate of scorch is very slow, and for the average compound the scorch test run at 212°F. would be a long and tedious task.

At 230° F. we find scorch curves which are quite similar to those at 212°F. but their slopes are more abrupt and the time required for scorching has been decreased considerably. The rubber compound (R) now runs along at a constant plasticity for only about 15 minutes and then the curve sweeps upward more abruptly to the scorching point than it did at 212°F. The scorching time has decreased from 90 minutes at 212°F. to approximately 30 minutes at 230°F. The neoprene compound (N) shows a scorch curve at 230°F. considerably steeper than at 212°F.; however, scorching still takes place by a gradual increase. The scorching time has been decreased from 268 minutes at 212°F. to 120 minutes at 230°F.

A temperature of 230°F. more nearly approaches an ideal temperature for running scorch tests. It is, however, still a little low, since the time necessary to cause the scorching of these compounds is still too long to make this a quick, efficient test. Experience has shown that 250°F. is a good standard temperature for running Mooney scorch tests.

At 285°F., an active curing temperature, one can readily see from the curve sheet that scorching takes place so rapidly that a clear picture of the scorching characteristics cannot be obtained. It is therefore desirable to run scorch tests at a temperature somewhat lower than the active curing range.

Curve Sheet No. 3 shows some typical Mooney scorch curves at a low, medium, and high temperature. It also shows that the effectualness of this test may be lost by running it at too high or too low a temperature. In passing, it is interesting to note the difference between the type of scorch curves of the rubber and neoprene compounds at 212°F. and 230°F. The rubber compound shows no signs of cure for some time and then quite abruptly, when vulcanization begins, sweeps upward to the scorch point. The neoprene compound reaches the scorch point by a slow increase in plasticity. The curve shows a very gradual increase from the point of the first noticeable cure to the scorch point instead of showing an abrupt sweep upward soon after vulcanization begins. This difference is, no doubt, due to the slow polymerization of the neoprene at these temperatures.



CURVE SHEET No. 4

Scorch Curves—Neoprene Type E vs. Type G

(4) The Determination of the Scorching Characteristics of Neoprene Compounds by Use of the Mooney Plastometer

The Mooney plastometer scorch test lends itself as readily to the determination of the scorching characteristics of neoprene compounds as it does to rubber compounds. Curve Sheets No. 4 and No. 5 show typical Mooney scorch curves of some neoprene stocks. On Curve Sheet No. 4 the scorching characteristics of Neoprene Type E are compared to those of Neoprene Type G. Compounds (P), (P-1), and (P-2) are similar compounds except for a change in the type of neoprene and a slight change in the amount of softeners. Compound (P) contains Neoprene Type E; Compound (P-1) contains 50 parts of Neoprene Type E and 50 parts of Neoprene Type G, and Compound (P-2) contains Neoprene Type G. The Mooney plastometer scorch test gives a very good comparison of these two types of neoprene:

Compound (P-2) mixed with Neoprene Type G scorches in about 10.5 minutes at 250°F. The scorch curve shows that polymerization begins very quickly at 250°F. The first sign of cure is noticed at approximately 3 minutes. The rate of cure continues slowly for another 3 minutes, and then the curve sweeps upward quite abruptly, reaching the scorching point in 10.5 minutes. Compound (P-1) shows the effect on the rate of scorching of substituting 50% of Neoprene Type E for Neoprene Type G. The length of scorching time has been increased by this substitution. The scorch curve of Compound (P-1) has flattened out somewhat and the slope of the curve up to the scorching point is more gradual than that of the (P-2) curve. The rate of polymerization at 250°F. has been reduced by the substitution of 50% Neoprene Type E for Neoprene Type G, and the scorching time increased from 10.5 minutes for Compound (P-2) to about 15.5 minutes for Compound (P-1).

When we examine the scorch curve for Compound (P) which was mixed with Neoprene Type E, we find a marked increase in scorching time over that of both (P-1) and (P-2). This test was not run to the completion of scorching; however, after 20 minutes, it can plainly be seen that the slope of the curve is just beginning to increase at a faster rate and at least several minutes more would be required to reach the scorch point. The scorch curve of Compound (P) has a much more gradual slope than the scorch curves of either (P-1) or (P-2), showing that the rate of polymerization at 250°F. is much slower. The curve of Compound (P) shows that polymerization does not begin for nearly 8 minutes, as compared to 3 minutes for (P-2) and 4 minutes for (P-1). The rate of cure is then very slow for another 8 or 10 minutes, after which time it increases somewhat.

The curves bring out the scorching characteristics of Neoprene Type E versus Neoprene Type G very clearly. They show that at 250°F. the polymerization of Neoprene Type G is considerably faster than that of Neoprene Type E. It has also been shown that a partial substitution of Neoprene Type E for Neoprene Type G decreases the susceptibility toward scorching. The reality of these scorch curves is borne out by practical results. It is commonly agreed that Neoprene Type G causes more scorching troubles than Neoprene Type E.

Curve Sheet No. 5 gives another illustration of the use of the Mooney plastometer for determining the

scorching characteristics of neoprene compounds. This test serves as a quick method for determining the activating effect which some ingredients have on the scorching characteristics of neoprene. The scorch curves here show the activating effect of pine tar on Neoprene Type E. Compounds (N-1) and (N-2) are the same except for the substitution, in Compound (N-2), of cottonseed oil and soft cumar for pine tar. The scorch curves show that pine tar does activate the scorching of Neoprene Type E. Compound (N-1) containing 8% pine tar (on weight of neoprene) scorches in 8.5 minutes, while Compound (N-2) in which 4% cottonseed oil and 4% soft cumar have been substituted for the pine tar, scorches in a little over 17 minutes. Pine tar seems to activate the rate of polymerization which begins very soon after the test is started, as shown by Curve (N-1), the first detectable signs of cure occurring at 2 minutes. Compound (N-2), without pine tar, shows no signs of polymerization until 10 minutes, the rate of increase of cure then being considerably slower than that of (N-1).

The two foregoing illustrations show the value of the Mooney scorch test in studying the scorching characteristics of neoprene compounds. Such a test is very useful to the compounder since it gives him a foreknowledge of just how touchy a compound is; therefore he may use precautions accordingly and possibly avoid burning in factory processing.

Summary

There are in use today several methods for determining the scorching point of rubber and synthetic compounds. Some compounders use the Williams plastometer method, while others press cure a thin slab of the compound for increasing periods of time at 220°F. or thereabouts until an examination of the slab shows vulcanization has taken place. Another method consists of heating several pieces of the compound in an oven and removing at constant intervals until the compound scorches. The test pieces in the latter method are quite often sheeted out on a mill in order to determine if any vulcanization has taken place. These methods all give good indications of the scorching point; however, each one is a rather long and tedious test.

The Mooney plastometer scorch test cuts down the time considerably and also gives a picture of the scorching rate, when the plasticity is plotted against the time. It is necessary as a rule, to run this test only 10 or 12 minutes at 250°F. in order to determine just how scorchy a compound really is, while the other methods cited sometimes require an hour or more in order to determine the scorching characteristics. It is also desirable to express the results of any test in the form of a graph or curve, so that one may make comparisons more easily without reviewing a lot of data.

The Mooney scorch test gives results which can be plotted in the form of a curve which also shows some very interesting facts aside from the scorching characteristics. The plasticity of the compound is shown, the point at which vulcanization begins, and the rate of vulcanization after it begins. Summarizing the advantages of this test in a few words, one can say that it affords a quick, convenient method for determining scorching characteristics and gives a clearer and more informative picture of scorching than other methods used today.

Just a few illustrations demonstrating the use of the Mooney plastometer as an instrument for determining scorch have been given in this report. They do, however, point out the value of this test in the following ways:

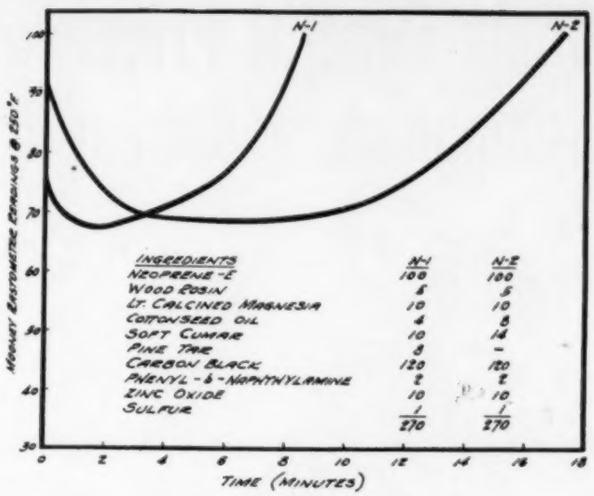
(1) The Mooney Scorch Test gives a quick method for studying the effect of various accelerators and accelerator combinations on the scorching characteristics of rubber compounds. It can also be used to show the effect of a retarder with various accelerators and the effect of any other compounding change which might have a bearing on the scorching characteristics.

(2) The Mooney Scorch Test may be used to show the relationship between scorching and rate of cure. As has been pointed out, there appears to be a definite relationship; however, before any general statements can be made, a considerable amount of work would be necessary. In the particular example cited here (Curve Sheet No. 2), one could visualize, from the shape of the Mooney scorch curves, the rate of cure of these compounds from the first signs of vulcanization up to the peak cure.

(3) The Mooney plastometer may be used to show the effect of temperature on the rate of scorching. It has been pointed out that experience has shown that 250°F. is a good standard temperature for running Mooney scorch tests.

(4) The compounding of neoprene may be studied in regard to scorching characteristics by use of the Mooney plastometer.

This paper has been presented with the idea of showing a rapid and reliable method for determining the scorching characteristics of rubber and synthetic compounds by use of the Mooney plastometer. Many compounders may be using the Mooney plastometer every day for determining plasticity and yet the use of this instrument for studying the scorching properties may be new to them. This method has been successfully used for several years and its results have been found to be dependable.



CURVE SHEET NO. 5

Effect of Pine Tar on the Scorching of Neoprene Type E

Acknowledgment

The writer wishes to express his sincere appreciation to S. R. Doner, K. J. Soule, and W. L. Sturtevant for their interest, willing cooperation, and suggestions given.

Some General Principles of Compounding Rubber Latex

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SEVERAL worthwhile books and articles have been published on the subject of rubber latex, its origin, methods of compounding and industrial applications. When most of these works were written the industrial use of latex had not reached the magnitude which it has attained in the last few years. It is therefore the purpose of this paper to summarize some of the previously published methods of compounding latex, omitting obsolete procedures, and discussing some general principles by means of which a latex compound may be formulated in view of present commercial practice.

The selection of the raw latex is much more important than commonly supposed. Normal latex of 40% concentration is the most economical in original cost and is relatively easy to handle. Therefore normal latex is used wherever possible but one must take into account not only the application of the latex but also the comparative cost of drying when deciding whether to use a normal or concentrated latex. Concentrated latices include the centrifuged, creamed, and evaporated types. The centrifuged containing approximately 60% rubber solids is perhaps most widely used as it contains only a small amount of water solubles. In some processes creamed and evaporated latices may be used interchangeably with centrifuged besides having some valuable properties for special uses.

Specifications should be set up for ammonia content, odor, total solids, rubber solids, color, mechanical stability, viscosity, and, in many cases, drying characteristics. Entirely different results are often obtained using the same formulation even with the same type of latex from two different sources.

Listed below are several components of a latex rubber mix which we will consider individually. In Group I are constituents used primarily to produce desired properties in the finished rubber film while in Group II are ingredients which are used for their effect on the liquid mix.

GROUP I

Affecting the Final Rubber Film:
- Activators
- Vulcanizing Agents
- Accelerators
- Antioxidants
- Fillers
- Odors and colors
- Softeners and tackifiers

GROUP II

Affecting the Liquid Mix:
- Dispersing Agents
- Stabilizers
- Wetting Agents
- Thickeners
- Coagulants and Gelling Agents

Group I—Affecting the Final Rubber Film

Activators:

As in milled rubber, zinc oxide is the most widely used activator, and, as might be expected, a very fine grade is most suitable for latex work. The usual percentages used are from 0.5% to 3%, the 3% giving the tightest cure. For transparency or lower modulus 0.5% to as low as 0.1% of activator is used, and it may be left out entirely if the accelerator is very active and contains zinc in itself. The presence of some zinc oxide gives faster curing as well as better aging than when none is used.

The amount of zinc oxide which has been reported (*1*) to give the most thickening in a latex mix is 0.68%. Choice of other compounding materials is, however, more important to avoid thickening than the amount of zinc oxide to be added. The type of accelerator and stabilizer used is significant and, for certain purposes, the removal of ammonia by formaldehyde with subsequent addition of caustic potash has a beneficial effect.

Zinc stearate and zinc carbonate are used only occasionally in place of zinc oxide and while somewhat harder to disperse do give fairly stable mixes. Fine particle zinc carbonate gives more transparent films than equal amounts of zinc oxide.

Vulcanizing Agents:

Again as in dry rubber compounding, sulfur is the most important vulcanizing agent. The usual ratios used are 0.5% to 1.5% on the rubber. Higher amounts up to 2% and 3% give a higher modulus and a dry non-tacky surface with resulting loss of resistance to heat aging and tearing. With percentages of sulfur from 0.5% to 0.75% a secondary vulcanizing agent such as elementary tellurium gives considerably greater resistance to heat aging and reversion. Of course tellurium because of its dark color, cannot be used in white or transparent films. Elementary selenium, an-

Note: This paper was awarded Third Prize in the 1940 Essay Contest sponsored by the New York Group, Rubber Division, A.C.S., and was presented at the October 18, 1940, meeting of that group.

other secondary vulcanizing agent, is beneficial in latex hard rubber compounds as it shortens the time required for curing and also gives a more flexible product than when sulfur alone is used.

Accelerators:

The choice of accelerator is probably the most important consideration when planning a latex compound. There is first the choice between water soluble and water insoluble accelerators. Water soluble accelerators have the advantage of easy incorporation into the latex but as many of the other ingredients to be added must be dispersed mechanically, this advantage is slight. In most cases all of the materials may be ball milled together to make a composite dispersion.

MacKay (*2*) has stated that water soluble accelerators are not extracted to any extent during water curing. The writer has seen several occasions where, although the water soluble and insoluble accelerators compared favorably in films, the soluble accelerators gave poorer aging when the latex mixes were applied in a thin coating on fabric. In all probability some of the water soluble accelerator was carried into the fabric by the water, resulting in less cure of the rubber.

Another point which must be considered is whether the latex mix is to be used up within a few hours or days, such as in coating processes, or is to be used over a long period of time with additions, such as in dipping processes. In coating processes, the fastest curing accelerators of the dithiocarbamate class or mixtures of dithiocarbamate and mercaptobenzothiazoles are used with little concern about the changes which might take place in the liquid mix upon long standing. In dipping processes the accelerator must be reasonably fast curing and must not cause rapid changes in the liquid mix over periods of several weeks. Zinc diethyl-dithiocarbamate has been tested (*3*) over a period of two months and found to be satisfactory. It is reported by Bachle (*4*) that water soluble accelerators are more likely to produce rapid changes in the liquid mix during storage than water insoluble ones.

Certain accelerators give more transparent films than others. As a rule, the dithiocarbamate type accelerators that produce fastest curing are most rubber soluble and give the most transparent films. Flint reports (*5*) that the speed of certain accelerators in a latex film is dependent on the alkali content of the parent mix. He points out that zinc diethyl-dithiocarbamate is faster than zinc dibutyl-dithiocarbamate when the latex is deammoniated while the reverse is true when the normal amount of ammonia is present.

Antioxidants:

To insure good aging properties an antioxidant is usually added to latex. Choice of antioxidant is governed, first, by length of life needed, and, second, by the color of the rubber article in which it is to be used. As in milled rubber, the most effective antioxidants for latex have the disadvantage of discoloring when used in light colored rubber films and, conversely, antioxidants which do not discolor noticeably give only moderate protection against aging. The number of commercial antioxidants in use is numerous, and the same antioxidant may give different degrees of protection depending on the utility of the article containing it. Probably the best method of drawing a definite conclusion is to test the antioxidant in the rubber film under the conditions in which it will be used.

As time will often not permit this method of testing, a fairly good comparison of antioxidant value may be made by physical tests of films before and after accelerated aging tests, such as air pressure heat tests, oven and oxygen bomb aging. The first two mentioned are preferred in latex work mainly because results may be obtained in a few hours or days. The oven test may be carried on at either 70 or 100 degrees centigrade. The fadeometer gives information on discoloration but this information should be supplemented by exposure to direct sunlight and also exposure behind glass to sunlight.

Besides effectiveness for ordinary aging and discoloration it should be kept in mind that certain antioxidants are more resistant to copper and manganese than others. Also a few antioxidants cannot be used with lacquers because they discolor the lacquer. Some give outstanding resistance to heat aging while others are especially good for natural aging at normal temperatures. The amount of antioxidant to be used is determined by effectiveness, cost and by the critical percentage at which that antioxidant may bloom.

Fillers:

Fillers are used in latex mainly to reduce cost. No practical way has yet been found to reinforce latex. All fillers merely act as diluents and reduce the tensile strength of the films. The writer has not been able to duplicate the work (*6*) by which Van Rossem and Plaizier claim to have reinforced latex with bentonite. Domestic clays and whitings are the common fillers used in latex. These are usually dispersed in water by stirring with a dispersing agent but may be sifted directly into the latex if the latex is highly stabilized. Fillers are used in fairly high amounts to produce a stiff film, and more whiting by weight can be used than clay to produce a corresponding hardness. Among the other fillers which can be used are reclaim dispersion, dispersed asphalt, ground cork, lithopone, blanc fixe and asbestos.

Odors and Colors:

Odors and colors are important in latex goods from the sales point of view. Odors of many different varieties are now available to either cover up the rubber odor or give the rubber film a pleasing aroma simulating nearly any perfume or flower. Colors are available in dry and dispersed forms. Wherever an inorganic water-insoluble pigment can be used, there is eliminated the danger of bleeding out or fading. However, many organic colors are now on the market which claim to have overcome these difficulties. The color should, of course, be compatible with latex in that it should not cause thickening or affect the curing rate and should contain no ingredients such as copper or manganese which would impair aging.

Softeners and Tackifiers:

Because of the fact that the rubber in latex is not broken down by milling, it is sometimes necessary to add softeners to produce a more flexible film or a tackifier to obtain better adhesion. Light mineral oils and waxes are emulsified before being added to the

latex and even then high amounts may bleed out or bloom to the surface. Glycerine is an effective softener but has the disadvantage of being hygroscopic and capable of being washed out. Certain types of latex concentrated by evaporation give a comparatively soft film. Tackifiers used in adhesives include rosin oil and pine oil, and organic solvents. These are usually added directly to a stabilized latex. Other latex adhesives are made by using solutions of casein, glue, gums, a water soluble rosin size, and commercial resins prepared especially for latex adhesives.

Group II—Affecting the Liquid Mix

Dispersing Agents:

Since activators, vulcanizing agents, antioxidants and many accelerators must be dispersed properly before being added to latex, dispersing agents are probably the most important of this second group. The two general types of dispersing agents are those which are dispersing agents only and have no effect on surface tension, and those which are both dispersing and wetting agents. The dispersing agents which do not lower surface tension are preferred to prevent foaming, for instance, in ball milling a dispersion of compounding ingredients. If a wetting agent is to be added anyway, a combination wetting and dispersing agent may be helpful. It should be pointed out in this connection that not all wetting agents are good dispersing agents (*7*) and some even flocculate fine powders when added to a water dispersion of them.

Stabilizers:

Very few latex mixes are made which do not contain some stabilizer. In preparing the vulcanizing dispersion the usual practice is to add a small amount of stabilizer. This stabilizer insures uniform mixing of the dispersion with the latex and helps prevent settling out of the ingredients in the dispersion itself. From 3% to 5% of casein, as ammonia casein solution, and 2% to 3% caustic soda or caustic potash on the dry powders give a suitable dispersion. Additional stabilizer such as casein, caustic soda or caustic potash is frequently added directly to the latex before adding materials which would otherwise cause immediate thickening or even coagulation. Contrary to the belief of many, caustic soda and caustic potash may be used in latex in amounts up to 1% on the rubber without impairing the aging qualities of the rubber film.

The amount of stabilizer should be governed by the method of application of the latex mix. A mix which is to be kept in a circulating tank for weeks or used under a coating knife must obviously be more stable than a saturating or impregnating bath. The least amount of stabilizer necessary is used since high amounts such as over 2% may produce a stiffening or a harsh feel in the final film. Besides casein, caustic soda and caustic potash, glue and starch are sometimes used. Gums which are used for thickening as well as some of the wetting agents also have stabilizing properties.

Wetting Agents:

Wetting agents have assumed considerable importance in the last few years. Addition of these to latex insure better penetration of latex in impregnating processes and are also used in surface coatings to obtain good anchorage of the latex film. The wetting agent should be selected for its effectiveness on the material to be impregnated and for its behavior in the medium in which it is to be used. Some wetting agents are more effective than others when used in mixes having a high pH. Certain ones give good results in dilute mixes of 30% rubber or less while they may cause a 60% latex to gell upon standing.

Thickeners:

In processing it is often found necessary to thicken a latex mix in order to provide a heavier film after dipping or to give a paste suitable for application by means of a doctor blade or pick-up roll. Converted starch is used in large quantities in rug backings where it acts both as a filler and a thickener. Gums such as karaya and locust bean also are used and can be made to give mixes which have a fairly low viscosity but can be spread on fabrics without striking through. Karaya gives a stringy type of mix while locust bean gum gives a mix from which the drops will "break short" when poured. Many chemical methods of thickening are listed in the literature but most of these are progressive and the latex mix continues to thicken upon standing.

Coagulants and Gelling Agents:

Because the fluid nature of latex makes building up of a heavy film difficult, several methods have been developed to build up films of suitable thickness with the minimum number of applications. In the dipping (*8*) of latex articles the form may be coated first with a coagulant consisting of an inorganic salt dissolved in a rapidly drying solvent and then immersed in the latex for a definite period, or the coagulant may be used to solidify the wet latex on a form and keep it from flowing; or a combination of both may be used. Mixtures of solvents and acids are used in the same manner.

Gelling agents are sometimes referred to as delayed coagulants and are added to latex to produce a solid film at the desired time either by increased heat or even at room temperature. These gelling agents are essential in the Kaysam process *(9)* and also in the making of latex sponge (*10*). Applications of these gelling agents have also been made in other fields, such as dipping, impregnating and coating with latex for ease of processing and for certain other desired results.

Conclusions

It may seem from the foregoing that latex compounding is complicated. It will however be noticed that certain of the compounding principles of milled rubber apply also to latex. Many of the difficulties experienced with latex are due to the physical state of the rubber latex. Variations which are often noticeable in dry rubber mixes from smoked sheet may be amplified many times in latex mixes. The behavior of these latex mixes is quite dependent on source and subsequent handling of latex, the combination of compounding ingredients used, and the conditions, such as temperature and mechanical manipulation, after compounding.

(Continued on page 106)

Rubber Conservation Methods in Germany

BY E. G. HOLT

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Germany today appears to be nearly self-sufficient from the standpoint of rubber. That statement may prove surprising to many members of the British and American rubber industries. Yet the statement is made and the facts behind it presented in the following article, which is taken from the initial edition of the new "Industrial Reference Service, Part 10, Rubber and its Products," the latest service offered to industry by the Bureau of Foreign and Domestic Commerce.

NAZI Germany early adopted a definite program to free Germany from dependence on rubber imports in case of emergency, and to conserve exchange. This program was a coordinated, involved plan affecting all branches of the German rubber industry, a plan possible in its details to an authoritarian regime only. In order to clarify this plan, its parts will be listed under appropriate special headings, starting with synthetic rubber, the development of which was the keystone in the entire program.

Synthetic Rubber

Research for a material that could replace rubber in tires and other chief products, begun in 1925, was intensified in 1933. The development of buna by I. G. Farbenindustrie was announced in late 1934, with publicity indicating that this material would furnish the answer to the German rubber problem. In late 1936 the I. G. Bayer pilot plant at Leverkusen was turning out about 80 tons monthly of buna, and in early 1937 the first commercial plant at Schkopau was reputedly operating at 200 tons a month.

From 1934 through 1936, Continental Gummiwerke at Hanover was experimenting with tires and mechanical goods, and in 1937 was making 200 tires a day and 25 per cent of its mechanical rubber goods from buna; and two other firms were also experimenting with its application. In June, 1936, the Rubber Control Board assumed direction over distribution of synthetic rubber, allotments being confined to uses in which its properties offered special advantages, and to tires. Thus far, the development was mainly economic.

Difficulties Encountered

Large-scale synthetic production and use were impeded by difficulties in developing efficient production technique, manufacturing equipment, and plant organization; the requirement of immense capital for costly plant equipment; and by difference in characteristics of synthetic versus natural rubber, necessitating modifications in compounding and treatment, and costly adaptations of processing equipment and production operations in the factories. One particular problem was the development and use of chemical softeners.

With the start of the so-called Four-Year Plan, in September, 1936, the direction of operations turned preponderantly to military preparedness. In February, 1937, Hitler stated at the Berlin Automobile Show that if free business did not solve the problem of mass production of synthetic rubber, it would cease to remain free. The finances of the chemical, rubber, and automotive industries were insufficient for the huge program envisaged, and the Government announced in May a heavy import duty on natural rubber, intended to yield 100,000,000 marks annually, the revenue to be earmarked for development of synthetic rubber.

The actual revenue derived, if all the rubber imports paid the import duty, averaged $50,000,000 a year for the next 2 years, at prevailing exchange rates. The cost was passed to consumers through a 20-per cent increase in tire prices. The higher tax-paid price of natural rubber in Germany made it economical to use reclaim, and stimulated the substitution of synthetic for natural rubber in many products. This import duty at once removed the barriers to and provided means for large scale synthetic operations.

Plant Expansion

In mid-1937, German plans to produce Thiokol at Saarau were announced; probably production started in 1938. Production of buna at Schkopau was expanded, and a new factory capable of producing 25,000 tons annually was laid down there and was expected to be in operation in May, 1939. Probably individual units of the plant were steadily brought into production from the beginning of 1938. In mid-1938 the tire factories in Germany, after months of difficult adjustment in processes, equipment, and compounding, were reported able to process synthetic rubber into tires on a large scale. Previous to that time, all tires produced with buna were used for Army, Postal, and other Government vehicles, while mechanical rubber goods for German railways were by this time almost wholly made from synthetic rubber.

In May, 1938, another plant was started at Huls, Westphalia, to have capacity equaling or exceeding the Schkopau unit. The Huls plant was expected to be in operation early in 1940. The Schkopau plant was originally capitalized at 30 million marks—later increased to 50 million. The Huls plant was originally capitalized at 30 million marks.

There have been no authoritative statistics of synthetic rubber production in Germany, but the ultimate goal was alleged to be 6,000 tons monthly, enough to enable getting along without imports in case of national emergency, such as prolonged blockade, and especially

to meet requirements of military forces and public and other vital and indispensable transportation services. Considering the stages usual in this field—from laboratory experiment to pilot plant, to semi-commercial and mass production units—it is believed production in 1934 was under 10 tons, in 1935 less than 100 tons, in 1936 less than 1,500 tons, in 1937 perhaps 4,000 tons, in 1938 probably 10,000 tons, and in 1939 probably 25,000 tons, with late 1940 capacity presumably in the neighborhood of 60,000 tons.

There were reports in 1938 that rapid development was impeded by difficulty in provision of acetylene by the carbide industry, and this may have been a continuing factor. The estimated volume was not such as to materially affect natural-rubber consumption prior to 1938. In addition to buna and Thiokol, various other rubber-like plastics have been acquiring significance in the insulation of cables and for other purposes.

The synthetic-rubber developments in Germany were attended by considerable publicity at various stages in the German press, and in trade papers of their rubber industry. The program involved approximately 2 years of experimentation and pilot-plant operation, 2 years of difficult and expensive adaptation to tire manufacture, and 2 more years to reach mass production of, say, 5,000 tons monthly of synthetic rubber. In early 1939, some exports of buna rubber from Germany were shipped to the United States.

Scrap and Reclaimed Rubber

The Nazi program involved making the fullest possible use of domestic assets in the form of worn-out rubber products. As early as 1934, imports were increased, and exports of scrap rubber from Germany were practically embargoed by an export duty on certain types; before the start of the Four-Year Plan in 1936, steps were taken to accumulate a large inventory, the Rubber Control Bureau ruling that scrap rubber must be saved and collected, and dealers holding or firms using over 500 kilos monthly must report to them. Beginning in 1937, complete collections of all domestic scrap rubber was initiated, with the required cooperation of householders and junk dealers, the latter registering their stocks periodically.

During 1937, aggregate German imports of scrap rubber (bought mainly in United States, United Kingdom, France, Belgium, and Netherlands) amounted to about 40,000 tons, against an average of only 2,000 tons in 1931-33, and 9,000 tons in 1934-36; imports in 1938 at 16,000 tons continued above average, but the decline from 1937 indicates that the accumulation of domestic and imported scrap was by that time considered adequate.

German imports and exports of scrap rubber, based on the official trade statistics of Germany, are shown in the following table. In 1936 and 1937, imports of scrap rubber were to some extent concealed by entry under other import classifications, the foreign buying being very quietly conducted and spread over many countries without any serious market effect; the figures for imports in 1936 and 1937 are close estimates, based on analysis of official data.

The average imports of *crude* rubber into Germany in the 5 years ended 1936 were 58,630 tons annually. The amount of *reclaim* used is believed to have been no greater than in the United States at that time, probably averaging less than 25 per cent of the crude,

GERMAN FOREIGN TRADE IN SCRAP RUBBER

[In thousands of pounds]

Year	*Imports*	*Exports*	*Net Imports*
1931	5,200	8,323	— 3,123
1932	3,628	7,499	— 3,871
1933	3,965	6,146	— 2,181
1934	17,500	2,538	+14,962
1935	17,312	101	+17,211
1936	22,925	161	+22,764
1937	90,000	54	+89,946
1938	36,000	0	+36,000

or, at most, 15,000 tons a year, making an aggregate average consumption of 73,000 tons of crude and reclaim annually, aside from other materials and compounds used in rubber manufacture, which would probably increase the total average weight above 100,000 tons a year.

Nearly half this weight, or over 40,000 tons yearly, might be subsequently collectible in the form of scrap rubber, and the intensive collection of previously uncollected material in 1937 must have been a huge amount, aside from the heavy imports. Very possibly, at the end of 1937 and up to the outbreak of war, Germany had an inventory above 125,000 tons of scrap rubber, although the rate of reclaiming was also increased during this period.

Actual facts on the German reclaiming industry are not available. Observers believed the industry had a capacity of 12,500 tons in 1934. There are indications that reclaim was not so popular in Germany as in America during the 1920's, and that before the Four-Year Plan was inaugurated, use of reclaim in Germany advanced steadily, but only gradually. In the *tire* industry alone, figures up to 1934 indicated that only 7 per cent of the rubber used was reclaim.

In 1936 the German rubber industry was required to determine the amounts of reclaim usable in a long list of products, and thereafter to make a definite minimum percentage use of reclaim in specified rubber products.

Large extension of reclaiming plants by Continental was begun in 1937; a new plant, with a 7,500-ton annual capacity, was built by Deutches Regenierwerke, at Hamburg, and began operation early in 1938; and others were established or enlarged elsewhere in Germany. In 1938, bicycle tire treads were being made from synthetic and carcasses entirely with reclaimed rubber. The opinion is general that reclaiming facilities have been developed to a capacity enabling them to utilize scrap to the extent it is annually available within Germany, and the annual scrap collections there, aside from imports, are believed in recent years to average over 40,000 tons.

War developments enable Germany to draw additional scrap rubber from occupied countries and to operate reclaiming plants in the occupied regions. Even in 1936, German observers believed the country capable of furnishing itself with reclaim to the extent of 24,000 tons a year. It therefore seems that the reclaiming industry may *now* have materials and capacity for making 35,000 tons annually of reclaim for several years.

The German reclaiming problem is, however, complicated by the use of synthetic rubber in manufacture, necessitating careful separation of materials before

processing, as natural rubber and synthetic rubber cannot be successfully reclaimed in one batch—although separate reclaiming of some forms of synthetic rubber is practicable, and in May, 1939, it was reported that technical difficulties in reclaiming buna had been overcome in Germany. With practical cessation of imports of natural rubber, its future reclamation would lessen over a prolonged period of years.

Collecting Scrap Rubber

It may be remarked that a complete collection system for scrap rubber enabled German authorities to know definitely the extent of this resource; where absence of such a system makes this a matter of conjecture in the United States, where knowledge of actual past collections (calculated from available data) does not necessarily closely indicate the *full* potentialities (which are generally assumed to be in excess of past records, and are at least increased in ratio to the increased rubber consumption in this country). Germany, with limited supplies of scrap rubber, had need to know the exact quantity; the United States, with a normal excess of this material, has less need to know the exact limit.

In connection with scrap and reclaimed rubber, it appears that after restrictions were placed on use of rubber in German manufacture, there was a tendency toward increased use of the subsidiary materials. In January, 1938, the Government placed restrictions on the construction or enlargement of plants for producing goods from scrap or reclaim, and such manufacture was made subject to special permit. At the same time, it was again required that monthly reports be submitted by all firms holding in stock 500 kilograms or more, or consuming that amount during the month. In early 1939, the manufacture of many articles (such as toys) made until then from scrap rubber, was definitely banned.

Natural Rubber

The measures with respect to synthetic and reclaimed rubber were designed to reduce the demand for imported natural rubber, and from the beginning of 1937 there was presumably a definite saving of natural rubber, and a planned accumulation of stocks of rubber for military preparedness.

Net imports of natural rubber averaged 24,980 long tons annually in 1922-26, increased 17,220 to 42,200 tons in 1927-31, and again increased 16,430 tons to 58,630 annual average in the 5 years ended 1936. Annual figures were 1933, 54,120 tons; 1934, 59,330 tons; 1935, 62,899 tons; and 1936, 71,794 tons. The increase in 1932-36 over 1927-31 was less than for the preceding 5 years; and in view of the growing motorization in both civil and military equipment, there is no reason to believe significant accumulation of stock occurred in this period, except perhaps in 1936.

At the end of 1936, rubber stocks in Germany can hardly have exceeded 15,000 tons; throughout that year, moreover, there was constant publicity on shortage of rubber and tires within Germany, and the year-end stocks may have been little more than 10,000 tons. Imports were already being regulated by the Import Control Authorities, and there is reason to believe 1936 consumer tire shortage in Germany was caused more by the occupation of production facilities with supplying military demands and experimenting with synthetic rubber, than by the lack of material. Tire factories were reported operating at full capacity in 1936, while other rubber-goods producers were said to have operated at 60 per cent of capacity on the average.

It was reported from Hamburg that foreign firms in central Europe, who had been buying rubber through Hamburg, were compelled, by the German import and payment restrictions, to deal directly with other markets, and transit trade in rubber through Hamburg was only 22 per cent of the 1935 total against 28 to 30 per cent in the preceding 3 years. Exports of crude rubber from Germany were subject to license from November 16, 1935, but free-port stocks were not affected by this measure. On April 21, 1936, the Government took complete control over the purchase, manufacture, and sale of rubber, rubber compounds, and rubber solutions, all companies concerned having to register and conduct operations under permit. On October 19, 1936, the Government authorized the Rubber Control Board to take necessary steps to provide and keep a reserve stock of rubber in Germany for urgent requirements.

On October 28, 1936, another decree under the Four-Year Plan was announced by the Rubber Control Board, prohibiting use of rubber in production for a list of 114 articles, the more important including rubber balls and balloons, elastic bands, pedal rubbers, bathing shoes and bath mats, some hard-rubber items, and other non-essentials, many of which could be made of other materials. "Rubber", under the decree, included natural rubber, reclaimed rubber, and scrap rubber, but not synthetic rubber. This decree could hardly have reduced German demand for natural rubber more than 500 tons, or under 1 per cent a year.

The heavy import duty on natural rubber had the effect of raising its price 100 per cent, and thus made it economical to use more reclaim and facilitated also the use of synthetic rubber. The system of rationing rubber supplies, established in 1937 and continued thereafter, allotted to manufacturers monthly tonnages, usually a percentage of their 1936 consumption rate; previously quarterly allotments based on 1935 were made. No rubber-consumption figures were published after 1937; but up to that year, for the tire industry only, the tonnage of crude and reclaim combined was reported annually; the reported total consumption was: 1935, 42,000 metric tons; 1936, 48,000 metric tons; and 1937, 62,000 metric tons.

The restriction of rubber use in specified articles in 1936 did not apply to goods produced for export, and the Government subsidized exporters of rubber goods to compensate for the higher cost of crude rubber resulting from the import duty. The manufacture of many articles, other than tires, containing a high percentage of rubber, was restricted and in some cases prohibited after the first quarter of 1937.

On July 1, 1934, the Rubber Control Bureau (then newly established) limited bicycle tires to seven sizes and two grades, specifying the rubber content per tire.

Developments Since 1937

In late 1937, a standardization of automobile tires was made effective, reducing passenger car types from 37 to only 10. During 1937 there was no complaint from manufacturers concerning lack of raw

material. The net imports of rubber in 1937 reached the unprecedented figure of 98,200 tons; and at the year-end, Hamburg observers believed there were 20,000 to 25,000 tons of rubber in the hands of German manufacturers, and about 3,000 tons in Hamburg. The total figure for rubber in Germany was probably nearer 35,000 tons at that date, as the Government was certainly accumulating stocks (without attendant publicity, except with regard to the high rate of economic activity and motorization in Germany), and there was some saving of crude through reduced output of goods other than tires and through increased use of reclaimed rubber and synthetic rubber. In late 1937, the retreading of worn tires in officially approved retreading plants was made general, retreaders guaranteeing the life of tires retreaded.

In 1938, German rubber imports declined 8,000 tons to 90,200 tons, but imports into Austria increased 4,000 tons to 7,800 tons, so that the net decline for the combined area at the end of 1938 was only 4,000 tons. Rubber consumption as a whole in Germany was still increasing, it was reported, but the imports are believed to have resulted in further substantial additions to German stocks of crude rubber, possibly 15,000 tons being accumulated, raising the total at the year-end to an estimated 50,000 tons.

Imports of rubber in the first 7 months of 1939 were reported at 57,692 tons, an average of over 8,000 tons monthly for Germany and Austria. In early August, Germany buying was extremely heavy on the London market, allegedly amounting to 15,000 tons, but what part of this was shipped and actually reached Germany is unknown. It is probable that, at the start of the war, German stocks of natural rubber were less than 65,000 tons, and imports since that date have been very low, even allowing for some stocks taken over from occupied areas.

April 1, 1939, the Financial Minister was granted discretionary authority to allow duty-free importation of rubber in exceptional cases up to December 31—which might seem to imply that no duty-free imports had previously occurred, and would argue against the previous accumulation of a Government stock. In early 1939, however, it was stated that buna supplies were before long expected to suffice for all passenger-car tires, and it would be difficult to account for the 1937-39 high rate of rubber imports on grounds of consumption after consideration of the numerous restrictions and conservation measures, even allowing for expanded military requirements.

Trade Organization

The measures already reviewed do not furnish a complete picture of rubber developments in Germany, even for the items discussed, and it must be borne in mind that statements as to capacity of prospective synthetic rubber plants are from German sources and may not reveal the real situation. Enough has been collated to indicate the multiplicity of regulations affecting the German rubber industry prior to the war. There were, in addition, various measures affecting trade organizations and distribution of goods.

The tire-manufacturing industry in Germany was organized in a cartel, and under this arrangement control was exercised over: (*a*) prices and sales conditions; (*b*) compulsory terms of payment, credit, and supply; and (*c*) channels of distribution, the manufacturer being permitted to sell only at wholesale, and individual tire dealers operating only under official permits. There was some effort to reduce the number of tire dealers, estimated between 17,000 and 18,000.

Imports of rubber goods of all kinds except scrap rubber were reduced to a minimum. Exports of rubber goods maintained, as far as supplies would permit, but maintenance of exports in specific items were subordinated to the main objective of saving on the cost of rubber imports and reducing domestic demand for non-essentials. The cost of rubber imports so greatly exceeded the value of exports of rubber manufactures that the Government was not greatly concerned over the exports. After 1935, imports of rubber products were sharply reduced, but the aggregate of exports was somewhat increased, and during the first half of 1939 there was a sharp increase over the corresponding period of 1938. Maintenance of exports was partly on a barter basis, through clearing arrangements with particular countries, and was confined to tires more than to other products.

The average net exports in 1936-38 were 4,697 tons above the average for the 3 preceding years, and probably 50 per cent of this increase, or less than 2,500 tons a year, would represent fairly the increased amount of rubber involved in domestic manufacture of goods as a result of the import-export policy.

Labor and Wages

The rubber program, under the Four-Year Plan, also gave attention to labor. With a high rate of economic activity in the country complicated by extensive conscription, it was difficult for the rubber industry to obtain skilled labor. Large manufacturers established intensive training courses for unskilled labor to remedy the situation, and official regulations were issued to prevent enticement of labor from one industry to another through higher wages. The regulations also provided that employers must apply to the Government Employment Office for factory labor and could not conclude hiring agreements privately.

Certain conservation measures reached the private motorist. On October 31, 1936, the Reich Transportation Ministry warned motorists to save tires by two methods: (*a*) driving vehicles at a lower rate of speed, and (*b*) being careful not to overload the tires. No information on the effectiveness of this warning is available. In July, 1938, regulations specified tire capacity for various driving speeds; if the maximum speed was to exceed 90 kilometers an hour, a heavier tire was required. As stated elsewhere, the cost of the import duty on rubber was passed to tire users through a 20 per cent tire-price increase, but only small increases (5 per cent on garden hose and 3 per cent on hard-rubber goods) were necessary in lines using little new rubber, especially when cost was chiefly from labor.

War Measures

Promptly upon the declaration of war by the United Kingdom and France, two German war decrees, both dated and effective September 11, 1939, provided for confiscation of rubber, asbestos, and products thereof, and regulated their future distribution. The following is the reported summary of these decrees, in detail.

Decrees of September, 1939

"Decree No. 50 of the Reich Board for Rubber and Asbestos orders the confiscation of rubber and rubber goods (except tires, which fall under Decree 51), include rubber, solutions, reclaimed rubber, scrap and waste, and of asbestos and asbestos products. Exempt from confiscation are goods held by the army, police, the armed S.S., the auxiliary police, the frontier service, and the civilian safety and auxiliary services (air-raid precautions, etc.). Further are exempt 'economically important' products and goods held and used by the ultimate consumer and those held by manufacturers and trade for use as construction parts within four weeks from the date of the decree; all other goods (*i.e.*, not 'economically important' goods) in the hands of the trade or consumers, and those held by manufacturers for filling approved export orders. Provisions are made to insure the use of the confiscated goods for army and other important purposes. Goods and products falling under this decree must be reported by the holders.

"Decree No. 51 of the Reich Board for Rubber and Asbestos regulates the surrender of tires: exemptions from surrender and the future distribution of tires. The decree affects tires (also tubes and rim-bands and bead-bands) for bicycles and motorcycles, automobiles, delivery trucks, and trucks, tractors, and electric trucks and for airplanes. Finally, it affects solid tires. Bus tires and tubes are not affected by the decree. Exempted from confiscation are tires held by the army and other armed forces, and bicycle tires on bicycles in operation. The confiscation is carried out in three different ways: (1) Tires, including the spare tire or tires mounted on automotive vehicles permitted to continue operation, are confiscated, but may be used by the holder of the authorized vehicle until further notice. Effective September 20, the registration tags on automobiles do not authorize operation, unless the tags are officially marked with an angular red stripe. This symbol (∠) is given only in important cases. (2) Tires mounted on registered automobiles not admitted to operation after September 20 (*i.e.*, on idle vehicles) are confiscated, but have to be surrendered only on specific demand. (3) Loose tires must be surrendered on or before September 30, against receipt. The purchasing price will be fixed by the Reich Price Commissioner. In future, the purchase of tires can be made only against tire tickets issued, on application, by the competent authorities. The purchase of bicycle tires will be only against a bicycle-tire ticket, issued, on application, by the municipal governments."

Decree of March, 1940

A decree of the German Ministry of Transportation reported March 15, 1940, required that by May 15 commercial motor vehicles with giant pneumatic tires must be equipped with governors limiting the vehicles to a maximum speed of 40 kilometers per hour on level road, to reduce wear and tear both on the vehicle and on the tires. This speed limit applied to vehicles with tire sizes from 7.50 x 20 to 9.75 x 24, inclusive, with a loading capacity of 3.5 to 5 tons Larger vehicles were subjected to additional restrictions, the lowest maximum speed being 28 kilometers an hour. A special regulation applied to busses operated on special lines. After March 15, motor vehicles affected by the decree would be allowed registration only upon compliance with its provisions, often involving installation of new gas-suction devices or blocking of high-speed gears, or other changes. The speed limits were effective March 15. Each registered vehicle was required to have plates, indicating its maximum speed, affixed to both sides.

GERMAN FOREIGN TRADE IN RUBBER MANUFACTURES

[Metric Tons]

Year	*Imports*	*Exports*	*Net Exports*
1933	1,856	14,254	12,398
1934	3,326	13,365	10,039
1935	5,233	14,122	8,889
1936	3,137	16,895	13,758
1937	2,236	18,691	16,455
1938	1,833	17,038	15,205
6 mos., 1938	1,167	8,961	7,794
6 mos., 1939	1,447	11,990	10,543

The only subsequent regulations that have been reported date from the invasion of Belgium and Netherlands in early May, 1940. General regulations of the Reich Ministry of Transportation to 20 German special plenipotentiaries for local transportation called for further restriction and organization of both private and public automotive traffic. From German newspaper discussion it appears that operation of private vehicles, which had been already reduced to a minimum, was completely stopped except for essential professional services, as in the case of physicians. A reduction was effected in operation of passenger cars used for transportation by Government organizations.

Local automotive delivery and transportation services, previously affected merely through army requisitions and gasoline rationing, were reduced to the carrying of foodstuffs and other essentials and the service of factories working for the national defense, and for these services the rules called for further rigorous pooling of truck fleets. Long-distance truck hauling, which, despite gasoline restrictions and requisitioning, had been considerable, was reduced to an absolute minimum, and was in no case permitted where rail transport was possible.

It was further provided that production of passenger cars would be stopped entirely as of June 1 except for export, and output restricted to trucks, press reports stating that, with prudent operation, available vehicles sufficed to prevent any unbearable deficiency, even if the war should be prolonged.

The press reports stated that the new rules were not occasioned by lack of motor fuel, reserves of which were described as giving no ground for anxiety. However, it was said that the new measures would increase these reserves to the point where they will meet any maximum military requirements. It therefore appears the measures were precautionary in preparation for the period of "total war." It was reported from Lithuania that vessels were released from Belgian and Dutch harbors with cargoes for Baltic ports, including some rubber, after the occupation of the low countries by German troops.

Apparent Position Today

Germany today appears to be nearly self-sufficient from the standpoint of rubber, possessing ample resources in production of synthetic and reclaimed

rubber, also consequential stocks of crude rubber, even after a year's practical cessation of imports—enough to carry the country's economy for a considerable period, if not indefinitely.

Rubber manufacture, particularly in tires, demands numerous other materials, the chief being cotton, sulfur, carbon black and zinc oxide. Starting with very little of these in 1933, the country has developed synthetic cell-wool for cotton, produces sulfur sufficient for national needs, manufactures necessary quantities of carbon black from naphthalene, and recovers zinc from ashes and slag for zinc oxide. The tire industry, therefore, may be independent of foreign sources of supply, not merely for rubber, but for all these chief raw materials.

Conclusion

The measures adopted for rubber conservation in Germany do not necessarily indicate steps which, in national emergency, would be necessary or desirable for the United States, under our form of Government and in our economic situation. Measures adopted in Japan have been patterned upon the German restricted-consumption practices—with local adaptations—but with far less success in synthetic rubber, for which domestic raw materials are insufficient, and with more dependence on imported supplies of scrap rubber for their reclaiming industry.

British policy, however, with control of the sea lanes and plenty of rubber obtainable from their own possessions without weakening their foreign-exchange situation, has been to maintain rubber consumption (except in enemy or Axis-controlled areas) to aid the prosperity of their rubber-producing interests, on the one hand; while, on the other hand, in the United Kingdom factories, the effort has been to adapt the rubber industry to military needs, without conservation as such.

The rubber industry in Great Britain has been making new high records for rubber consumption in the two 6-month periods since the war began, and it would normally be expected that rubber consumption in the United States would be increased by our armament and preparedness program, if rubber continues available in ample supply.

It seems clear, however, that in the complete development and use of rubber reclaimed from worn-out rubber products, and in the retreading of tires, the German program is merely making sensible use, to the utmost potentialities, of its domestic assets, and that this part of their program might well be implemented here by all acceptable means.

In order to accumulate stocks of natural rubber as rapidly as possible, we in the United States could now be using more reclaimed rubber. Perhaps automobile manufacturers could be induced generally to adopt, for original equipment, tires containing a larger percentage of reclaimed rubber; perhaps the Government could purchase tires containing more reclaim; perhaps in certain other important products, such as rubber footwear and garden hose, rubber manufacturers could agree on use of a definite and higher percentage of reclaimed rubber. The immediate need to increase stocks of crude rubber in the United States is urgent, and the one domestic means within our own power to influence such stock accumulation is by saving in the consumption of new rubber—*now*.

Such measures would have other effects than merely building up stocks of new rubber. They would cause an increase in our production of reclaimed rubber, preparing that industry for its logical position as the "first line of defense" in our rubber economy. They would stimulate the collection and reduce the wastage of scrap tires and other rubber goods, which are now used for fuel to some extent, and would strengthen the collection and trading firms which might need to be better organized in emergency. Insofar as our imports of natural rubber were reduced over a long period by such a program, there would result a worthwhile saving in foreign exchange.

Safeguarding Shipment and Storage of Water Emulsions

WITH the approach of cold weather it is appropriate to call the attention of rubber manufacturers and other users of water emulsions of rubber and rubber compounds, such as Dispersite, the name given its emulsions by Dispersions Process, Inc., to the necessity for precautions against freezing in transit or storage. These emulsions will freeze at or near the temperatures that freeze water and this freezing sometimes breaks the emulsion and makes the product unsuitable for use.

All carriers, with the exception of the Railway Express Agency, disclaim responsibility for material frozen in transit; therefore, precautions must be taken to insure protection of the water emulsions from freezing. Suppliers take exceptionally good care of the material up to the time it is delivered to the carrier, and there is practically no possibility of its being frozen before it is shipped.

Once the water emulsions reach the manufacturer's plant, very definite precautions should be then taken to safeguard the material. It should not be exposed to freezing in shipping or storage sheds or departments for any length of time. The suggestion is advanced by the suppliers that users anticipate some of their requirements and bring to their plants, before severe cold weather sets in, a supply of the material for inventory. This action would eliminate to a large degree the risk of shipping during severe weather.

Should water emulsions of rubber and rubber compounds become frozen, it is often possible to bring them back to usable condition. This can best be accomplished by thawing gradually. No direct application of heat should be made at any time. The frozen material should be allowed to stand at normal room temperature or at moderately elevated room temperatures until completely thawed.

These precautions and method of procedure of thawing out frozen emulsions are suggested by Dispersions Process, Inc. A bulletin outlining precautionary methods in more detail can be secured without cost by writing to the company at 1230 Sixth Avenue, New York.

Industry's Challenge to Research

A List of New Products, Processes and Materials Wanted by Industry in General, Including Several Called for Both from and by the Rubber Industry

THE following question was recently put to America's outstanding industrial leaders: What new product, process or material might industrial research develop that would be valuable to *your* industry? The question was put before more than a thousand industrialists by the Research Advisory Service, maintained by a group of American banks, which accepted the task of conducting such a survey as its contribution toward the growth and development of industrial research and of American business. Answers received made a 375-page manuscript which was condensed into a 43-page summary, issued under the title, "Industry's Challenge to Research."

The summary is divided into 34 industrial classifications, including rubber, the "industrial wants" from each industry being grouped under each classification. We are reproducing herewith twelve specific requests made of the rubber industry, both of the suppliers to that industry and the rubber manufacturers themselves, as well as a number of other requests grouped under classifications other than rubber but which are of direct interest to the rubber field.

It should be pointed out that the Research Advisory Service was established to enable manufacturers of all kinds to find answers to their practical working problems. The inquiring company is under no expense or obligation and its identity is not disclosed without permission. The Service does not undertake research work of its own, but refers problems to laboratories in industry, universities, technical schools and trade associations which cooperate in the program. It does not compete with consulting engineers, chemists, testing laboratories, or marketing consultants.

In checking over the suggestions which follow, many readers will no doubt find several which are already receiving careful research study and some to which an apparent solution is already available, although the individual who expressed the demand for it may not find it suitable to his own requirements or may be unaware of its existence. The Research Advisory Service was created to assist in clearing up just such situations. Accordingly, in instances where items requested are already at hand, suppliers of such services or materials are urged to communicate direct with Mr. Bert H. White, Vice-President, Liberty Bank of Buffalo, Buffalo, N. Y., who is Director of the Research Advisory Service. The "industrial wants" which follow have not been edited in any way, but are presented in the same form in which they appear.

Industrial Wants of Rubber

1. Development of a domestic supply of natural rubber or a suitable substitute at prices competing with natural rubber.

2. Development of suitable rubber materials and compounding technique which will permit the economic use of rubber in highway construction other than fillers between the sections of concrete roadways.

3. Development of a form of rubber which would not lose so much of its traction on wet surfaces. Possibly some of the rubber substitutes could be formulated with some such property in mind.

4. A modified rubber or substitute material similar to crumb or powdered rubber which could be prepared and sheeted or molded without the high cost involved in present heavy machinery and processes preparatory to fabrication.

5. The development of a sheet rubber flooring which would be competitive with linoleums, taking into account the increased service which rubber offers.

6. Tires for the road building equipment manufacturer which embody only such features as static load carrying ability, oil and sun resistance, 2,000-mile life, and speeds up to 20 miles per hour with traction speeds up to 40′ per minute. We now must over-tire our equipment with tires having features we have no use for.

7. A rubber-like material which would retain its properties at temperatures of 500° F.

8. A process to reclaim synthetic rubber such as neoprene, Thiokol, etc.

9. One of the greatest developments in the progress of the rubber manufacturing industry was the application of carbon black obtained by allowing the flame of burning natural gas to impinge against a cold metal surface. We would like a white powdered material with approximately the same degree of fineness and the same reinforcing effect on rubber. This would be a distinct contribution to the advancement of the rubber industry.

10. In the manufacture of molded and extruded rubber products, many fillers are used including limestone, clay, mineral earth, and wood flour. We need a good gravity reinforcing pigment, preferably light in color, that will deliver at 1¼c per lb. The tonnage is large, our consumption alone in 1939 having been over 12,000,000 lbs.

11. An economical process of removing sulfur from vulcanized rubber which would leave the scrap as it was before vulcanization.

12. Material to be added to a rubber mix to reduce the diffusion of air through the rubber.

Miscellaneous Industrial Wants

The following "industrial wants," all of interest to the rubber industry or to its suppliers, were taken from various classifications in "Industry's Challenge to Research," other than rubber, as indicated by the references which appear between parenthesis at the end of each item:

Cement for quickly bonding rubber and metal. (Item 5, Adhesives Section).

The production of Montan Wax in the United States, now dependent on imports from Germany. Here is a golden opportunity for promotion of a new American Industry. (Item 15, Chemicals Section).

A substitute for Carnauba Wax. (Item 17, Chemicals Section).

A generally applicable material for dissipating static electricity from paper, driving belts for machinery, artificial silk, etc. (Item 37, Chemicals Section).

The rubber industry needs an antioxidant which would not discolor white and light colored stocks. (Item 41, Chemicals Section).

A means of purifying talc to remove iron oxide. (Item 43, Chemicals Section).

There is need for colors in all shades, stable against hot air and steam, to be used in rubber manufacturing. (Item 3, Dyes & Colors Section).

A white ink for printing on dark colored corrugated board with rubber plates. (Item 6, Dyes & Colors Section).

A substitute for that electrical conductor known as "BX" which consists of two rubber-insulated wires inside a spiral of iron tape. The substitute should be one rubber-insulated wire inside a metal tube which is thin, tough, ductile, seamless and capable of being bent around corners. The wire is to be the "hot" side of the circuit, and the metal tube the grounded neutral of the system. (Item 11, Electrical Equipment Section).

The nozzle on the sand blast machine used for cleaning castings needs constant replacement. A rubber-lined nozzle might give better results. (Item 28, Machinery & Machine Tools Section).

Develop defense weapons, economic, mechanical and chemical, so powerful that America could be kept out of war. One of America's weakest points is its supply of rubber. Technical improvement of reclaimed rubber so as to replace crude rubber would be of great benefit. Substitutes should be developed for tin and other products in which America is deficient. This would also develop new industries. (Item 1, Miscellaneous Section).

In the coating of paper and cloth, a most valuable new product would be a coating material with the working and drying qualities of a pyroxylin lacquer, the gloss and body of a varnish, and the flexibility of rubber. (Item 16, Paints & Finishes Section).

Our equipment is called upon to withstand both continuous abrasion from gritty material and corrosion from sulfuric or phosphoric acid. We have investigated numerous paint products, including rubber base paints, but none proved satisfactory. Our equipment is so large that it must be shipped knocked down and assembled in the field, making rubber covering difficult. (Item 31, Paints & Finishes Section).

A tire cord of much higher tensile strength and ability to withstand the extreme flexing requirements and high temperatures of the modern tire. (Item 11, Textiles Section).

A four-page bulletin (No. 11) on **Meehanite**, which includes a table of properties available in Meehanite dies as well as a variety of applications and performance records, has been issued by the Meehanite Research Institute, 311 Ross St., Pittsburgh, Penna.

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Actual performance records of **DoAll Saws** on different materials and various jobs are given in a new booklet now being distributed by the Doall Co., Des Plaines, Ill. Selection of the proper saw for metal cutting is discussed.

Marbelite Casting Materials

SIMULTANEOUS with the rapid growth in the use of latex molds in the ornamental plaster studio is that of marbelite casting materials. Marbelite is a solution of potassium alum, heavy spar and water, and because it is cast hot it cannot under any circumstances be used with glue molds. Previously, the only mold available for this type of casting was the rubber mold vulcanized by the usual procedure. Such molds are expensive and accordingly the use of marbelite was practically restricted to higher price castings. It is due directly to the low cost of the latex mold that marbelite casts in great variety and quantity have recently flooded the chain stores throughout the country.

A marbelite formula is: Potassium Alum, 100 parts; Heavy Spar, 10 parts; Water, 10 parts. (Parts are by volume). The alum is heated in water until it boils and the spar added while stirring. The stirring should be continued for approximately five minutes after removing from the fire otherwise the ingredients will separate. The mixture is then poured into the mold and allowed to cool before removing the cast. Reducing the spar up to one part reduces the transparency of the marbelite accordingly. Marble dust may be added to give extra weight to the cast. Utensils used for melting the marbelite solution must be of copper. A mixing device can be made by binding together a few lengths of copper wire.

Compounding Rubber Latex

(Continued from Page 98)

The recent development of synthetic rubber or elastomers offers certain possibilities in the latex field. As most of these synthetic products are polymerized in emulsion form, there may be produced types of latices which would be uniform and not possess many of the disadvantages of natural latex. The absence of proteins and sugars as well as the more or less fugitive ammonia would give a latex less subject to change either before or after compounding. The absence of ammonia would reduce greatly the destabilizing effect of zinc oxide which often causes thickening and sensitivity to coagulation. When and if such synthetic latices are developed commercially much of the uncertainty and close control now necessary with natural latex should be eliminated.

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(8) Teague, U.S.P. 1,719,633 (1929); Willson, U.S.P. 1,908,719 (1933).
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All needed types of control devices can now be organized in locker-like motor control centers instead of the usual "pillar and post" method of mounting by means of a new engineering idea in motor control installation devised by Cutler-Hammer, Inc., Milwaukee, Wisc. The company terms the new idea **"Unitrol"**, and has literature available describing it.

Editorials . . . . . .

Lesson in Conservation

THERE is an old bromide to the effect that wise is he who can profit from the experience of others. Are we in this country wise enough to apply that maxim—and apply it quickly? If so, there is a lesson to be learned from the methods of conserving rubber supplies instituted by Germany several years ago shortly after the Nazi Party assumed power. These methods, which have resulted in the Germany of today being practically self-sufficient in the matter of rubber supplies, are carefully traced by E. G. Holt, Chief of the Leather and Rubber Division of the Bureau of Foreign & Domestic Commerce, elsewhere in this issue.

As Mr. Holt states, it is not essential that the United States follow the exact pattern of rubber conservation instituted and carried through so successfully by Germany. Our method of Government and economic policies, in fact, make it undesirable to follow the same pattern. But we can—and should—adopt some of the principles so that any possibility of a rubber shortage in the event that shipments of crude rubber from the East are severely curtailed would be forestalled.

Mr. Holt considers reclaimed rubber as the "first line of defense" in our rubber economy. Therefore, he argues, in order to conserve as much new rubber as possible we should begin using more reclaim as soon as possible. Perhaps automobile manufacturers could be induced to adopt, for original equipment, tires containing a larger percentage of reclaim; perhaps the Government could purchase tires containing more reclaim; perhaps rubber manufacturers could agree among themselves to use a definite and higher percentage of reclaim in the production of certain articles, such as rubber footwear and garden hose. These are only a few suggestions; many more come readily to mind.

The importance of conserving rubber, of building up strategic piles for use in emergency, has been stressed ever since hostilities abroad began. Every new suggestion along these lines merits attention. Mr. Holt's suggestions are based, to some degree, on already accomplished fact. We suggest that every member of the rubber industry consider the conservation methods instituted by Germany. And then put his "thinking cap" on.

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Challenge to Research

IF there be one single chemist, engineer or technologist who labors under the belief that the age of opportunity is dead, let him look over the list of "industrial wants" published elsewhere in this issue under the title, "Industry's Challenge to Research." The "wants" published are only those which pertain of or to the rubber industry, and represent but a small percentage of the more than 1,000 suggestions received by the Research Advisory Service in answer to the question, "What new product, process or material might industrial research develop that would be valuable to your industry." The question was put to leading industrialists throughout the country, representing a cross-section of American industry.

Consider some of the requests made: Development of suitable materials and compounding techniques which will permit the economical use of rubber in highway construction; development of sheet rubber flooring which would be competitive with linoleums; a process for reclaiming synthetic rubber; a rubber-like material which will retain its properties at temperatures of 500° F. or more. True, laboratory research has been and is now being conducted along some of these lines. But bringing industrial demands out in the open, as this excellent survey did, should spur the efforts to a point where realization may be in the offing.

CURRENT NEWS OF THE MONTH

1940 DOLLAR SALES VOLUMES MAY EXCEED THOSE FOR 1939

Sales of tires and tubes provide, on the average, 60% of the annual volume of the rubber manufacturing industry, while innumerable miscellaneous products, such as rubber parts for automobiles, industrial belting, rubber footwear and clothing, etc., account for the balance. In the tire category, shipments of replacement tires make the major contribution to both volume and profits. In the mechanical goods division also, profit margins are relatively wide.

Based on these observations, made in the latest report on the rubber and tire industry by the Research Department of Fenner & Beane, statistical organization of New York City, about half of the rubber industry's yearly earnings are attributable to the activities of the tire and mechanical goods divisions, as compared with a 40% participation in the annual sales total. For the current year, the report continues, dollar sales volumes of the major companies are likely to exceed those for 1939 by moderate margins, but other factors bearing upon earnings present a less favorable aspect.

Lower Prices Have Prevailed

Reflecting increased automobile production, shipments of original equipment tires for the first nine months of 1940 have run 24.4% ahead of those for the same period of 1939, but the gain has been offset by a decline of 9.1% in replacement tire shipments during the same period. More importantly, lower prices than in the earlier part of 1939 have prevailed and profit margins have been impaired further by higher crude rubber costs. Increased sales of non-tire products have failed to offset unsatisfactory conditions in the replacement tire division; in the face of a 6.8% gain in sales, aggregate profits of five companies declined 21.6% in the first half of 1940.

Over a period of years, such instability of earning power has been a characteristic feature of the rubber manufacturing industry. Raw material costs constitute a large proportion of operating outlays and crude rubber prices have been subject to wide and erratic fluctuations. In typical cases, moreover, leverage provided by heavy senior capitalization intensifies the consequent rise and fall in earnings applicable to equity issues. Against an erratic profits record, however, the industry has exhibited a strong tendency toward physical expansion.

Representing in part increased poundage per tire and, more importantly, development of new uses for rubber, annual absorption of crude rubber in 1940 will approximate 600,000 tons compared with 575,000 tons in 1936 and 469,000 tons in 1929. In looking forward to 1941, maintenance of physical demand for rubber products at a high level appears well-assured, but improved profits depend on increased selling prices.

Streamlined Rain Slippers

Streamlined rain slippers, made of South American rubber, which may be candy colored or as transparent as glass, were recently introduced by Bonwit, Teller & Co., New York department store. The new rubbers are seamless, and fit high, low or wedge heeled shoes. The soles are non-skid. A wide color range is offered.

ACID-PROOF CLOTHES REPORT IS MADE TO HEALTH SERVICE

A report has been made to the Public Health Service by Louis Schwartz and Leon H. Warren, together with Frederick H. Goldman, on tests made with 17 fabrics and films of synthetic resins to determine their effectiveness in protecting workers in industries using skin-irritating chemicals. The reagents employed included carbon tetrachloride, ethylene dichloride, ligroin mineral oil, vegetable oil, ethyl alcohol, 20% commercial hydrochloric acid, and 40% solution of potassium hydroxide. Of the materials tested, Pliofilm, Koroseal and Vinylite were found most satisfactory.

The three materials mentioned not only prevent irritants from coming in contact with the skin but protect the clothing, according to the report. They are light weight, transparent, and although they increase and retain perspiration they do not have the objectionable feel of rubber. The materials are non-flammable and can be easily cleaned with ordinary soap and water. When given ordinary care, they will last a number of months.

INCREASED USE OF RUBBER EVIDENT IN 1941 AUTOMOBILES

That rubber continues to play an ever-increasing important role in the manufacture of automobiles was evident at the 1940 National Automobile Show, which opened at Grand Central Palace in New York City under the auspices of the Automobile Manufacturers Association on October 12 and ended on October 20. Eighteen different makes of passenger cars were on exhibit.

It was immediately apparent that a number of manufacturers have adopted latex foam cushioning for their seats, although a few continue to offer this type of seating on an optional basis only. Hudson, Ford, Mercury, Lincoln and Oldsmobile are among models offering latex foam cushioning as standard equipment. Rubber insulators, or body mountings as they are known, are in use on all cars, although in some cases, as that of the Ford models, the insulators are twice the size of those previously used.

Running Boards Eliminated

Running boards have been eliminated in many of the 1941 models. However, as in the case of the Chevrolet cars, a safety step is used beneath the lower edge of the door, and this step is surfaced with heavily ribbed rubber. Running boards on Cadillac models, which are concealed when the doors are closed, are rubber-covered. Hudson, which still makes use of running boards, is featuring a narrow board which has a broad stainless steel outer molding with matching parallel strips of stainless steel inset in a safety rubber tread.

Synthetic rubber parts are being widely used, particularly in those applications where resistance to sunlight, heat, gasoline, ether and oils is involved. The Dodge models, for instance, are now using synthetic rubber dust seals on the front end of crankshafts while flexible boots surrounding universal joints are made of the same material. Both of such parts were previously made of leather. Gas tank filler necks now have flexible joints of synthetic rubber connecting them to the tank proper, and the fuel again passes over the same material in the neighborhood of the fuel pump. Synthetic rubber is also being used, impregnated in special carton materials, to make oil-seal gaskets at various points in the new models.

NEW SOURCES OF RUBBER CONTINUE TO FILL NEWS

With the threat of cut-off shipments of crude rubber from the East still hanging over the head of the domestic rubber manufacturing industry like a Damocles' sword, it is small wonder that constant references to new sources of rubber, particularly in South and Latin American countries, continue to show up in the daily press. At the same time, the Department of Agriculture is losing no time in making surveys in these same countries to determine the best possible sources for new rubber cultivation, in accordance with the appropriation voted for this purpose recently.

Dr. Llewellyn Williams, curator of economic botany of the Field Museum of Chicago, who returned to this country on October 25 after having spent two and one-half years on leave from the museum in the service of the Venezuelan Ministry of Agriculture and Animal Husbandry, reported that wild rubber is growing in abundance under ideal conditions adjacent to an all-water route to American processing plants in an area of 40,000 square miles in the virtually unexplored valley of the Orinoco in Venezuela.

Region Abounds in Flora

Dr. Williams expressed the belief that the development of rubber plantations in the area between the Orinoco and the Amazon basin, one of the least known regions of South America and one that abounds in flora of commercial possibilities, may go a long way toward solving permanently the rubber supply problem of this country on a sound economic basis that is strategically defensible. He said that the Venezuelan Government is very anxious to attract American capital in the exploitation of this area.

About the same time it was revealed that Carl D. LaRue, botanist of the University of Michigan, will soon leave for a five-month tour which will take him over the Andes and into the wild rubber country of northern Bolivia and the Upper Amazon. Dr. LaRue, who was research botanist for the U. S. Rubber Co. in the Far East from 1917 to 1920, will head a Department of Agriculture expedition. Since 1918, he has been urging the introduction of "black" rubber into cultivation. "Black" rubber, he explains, is a better producer in its natural state and it is quite possible that if it can be successfully cultivated on plantations its yield may be greater than the already large yield now taken from "white" rubber trees.

Praise for development of millions of acres of rubber trees in the Amazon was given to the Ford Motor Company by Dr. Armando Vidal, Commissioner General of Brazil at the New York World's Fair, last month. The development, he said, not only represents a chapter of Brazilian economy, but constitutes one of the indispensable links in the chain of national defense in the United States as well as other American countries, and perhaps some European countries that depend on rubber from the Orient.

New Tire Tube Lining

A new tire tube lining that increases tire mileage as much as 25% by maintaining proper inflation pressures at all times, is said to have been developed by the Firestone Tire & Rubber Co., Akron. Known as "Nitrox," the new lining is reported to have proved its ability to retain air under pressure in laboratory and road tests better than an unlined tube five times as thick.

Moves Boston Headquarters

The Boston office of H. Muehlstein & Co., Inc., dealers in scrap rubber, has been moved to 1145 Park Square Building, 31 St. James Avenue. The company, which has its headquarters in New York, maintains branch offices in Boston, Akron, Chicago, Los Angeles and St. Louis. Warehouses are maintained in Jersey City and Akron.

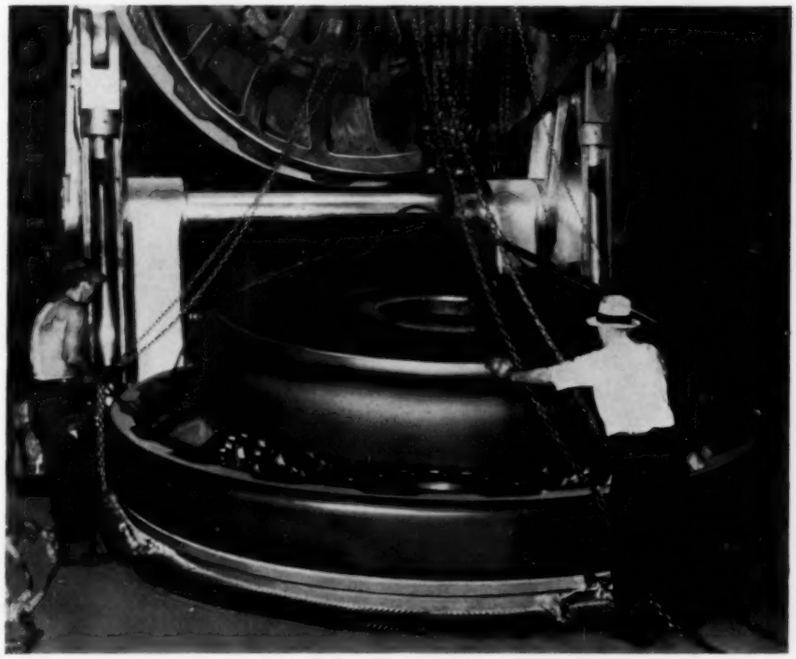
AMERICAN PHYSICAL SOCIETY SPONSORS RUBBER SYMPOSIUM

The Ohio Section of the American Physical Society was the sponsor of a Symposium on the Physics of Rubber, held at the University of Akron, in Akron, Ohio, on October 11 and 12, 1940. In all, eight papers were presented, their titles and authors being as follows:

Physics in the Manufacture and Use of Rubber, James W. Schade (Goodrich); *Thermal Problems in Rubber Manufacture*, Stuart H. Hahn (Goodrich); *Optical Properties of Rubber*, Dr. Lawrence A. Wood (Bureau of Standards); *Dielectric Constant and Power Factor of Koroseal at Radio Frequencies*, O. R. Fouts (University of Akron); *An X-Ray Study of the Proportion of Crystalline and Amorphous Components in Stretched Rubber*, J. E. Field (Goodyear); *Infrared Spectra of Rubber*, W. C. Sears (Goodrich); *Some Applications of the Kinetic Theory of Rubber Elasticity*, H. Mark (Brooklyn Polytechnic); *Physical Characteristics of Synthetic Rubber*, J. N. Street and J. H. Dillon (Firestone).

Richard H. Howe, of Denison University, Granville, Ohio, is secretary-treasurer of the Ohio Section of the American Physical Society.

63,000-POUND MOLD USED TO VULCANIZE EARTH MOVER TIRES AT FIRESTONE



A crew of 10 men, with pulleys, chains, windlasses, blocks and levers, spent eight hours moving both sections of the huge tire mold pictured above from the shipping platform into the plant of the Firestone Tire & Rubber Company at Akron. The mold, weighing 63,000 pounds, is used to vulcanize the company's giant 36.00-40 earth mover tires, the largest ever produced, according to Firestone officials. The tires, themselves, stand 9½ feet high, with the tube and flap, weigh 3,646 pounds, and carry 55,000 pounds.

BUFFALO RUBBER GROUP HEARS FIRST DISCUSSION OF "HYCAR"

Appropriately enough, the approximate 95 members and guests who attended the first regular meeting of the recently-organized Buffalo Group, Rubber Division, A.C.S., held at the Lenox Hotel in Buffalo on Thursday, October 17, heard the first public discussion of "Hycar," the name given to the synthetic rubber to be merchandised by the also recently-organized Hydrocarbon Chemical & Rubber Co., of Akron, Ohio. This is the same material developed by Goodrich under the name of "Ameripol."

The discussion was in the hands of F. M. Andrews, sales manager of the Hydrocarbon concern, organized through the joint action of the B. F. Goodrich and the Phillips Petroleum companies, and W. D. Parrish, in charge of technical service for the same firm. Immediately following an excellent dinner, Mr. Andrews was introduced by John S. Plumb, of the U. S. Rubber Reclaiming Co., Chairman of the Group.

Mr. Andrews approached the discussion of Hycar in a direction that was appropriate for one who has been long associated with the petroleum industry when he pleaded for the increased use of all the synthetic rubbers in order that familiarity in handling may be achieved against that possible day when supplies of natural rubber transported 13,000 miles over ocean may be cut off.

Butane Can Be Made Cheaply

The raw material of many of the synthetic rubbers, and Hycar in particular, is butane, and this can be produced cheaply. In fact, stated Mr. Andrews, the 600,000 tons that the United States annually uses at a cost, to be sure, which is presently much higher than natural rubber, can be supplied by our synthetic plantations in Oklahoma and Texas. With increased production synthetics can certainly be made more attractive in price and be reasonably free from the cost fluctuations always present in the natural rubber market.

Mr. Parrish gave a resumé of synthetic developments extending over the last eighty years and described how Germany, confronted with the loss of all imports of natural rubber during the World War, developed and utilized to some advantage, over 2500 tons of methyl rubber. For the sake of orienting his audience in the modern synthetic field, Mr. Parrish showed the basic differences of structure and derivation of the several types of synthetics available in the United States today.

The technical exposition of the synthetic Hycar consisted of data and pictures shown on slides, a demonstration of the coagulation of the aqueous emulsion to produce the solid rubber, and a display of industrial products all made from Hycar and Hycar O.R., the oil-resistant type of the company's butadiene copolymer. Mr. Parrish also distributed mimeographed sheets giving the results of a number of tests made to indicate the physical and chemical characteristics of the new synthetic rubber.

Following Mr. Parrish's technical discussion, a surprise appearance of the "Rt. Hon. Geoffrey Beavencourt" at the meeting was announced. Present through the good graces of Col. Kelly of the Niagara-Hudson System, Mr. Beavencourt delivered a most unusual discourse on the "War Behind the War." He faithfully promised never to repeat the discussion, while all members and guests present were sworn to secrecy.

The next meeting of the Buffalo Rubber Group, which will be the first annual Christmas Party, will be held sometime in mid-December. Announcements will shortly be distributed by Burt W. Weatherbee, of the Globe Woven Belting Co., Buffalo, N. Y., secretary-treasurer of the Group.

Coming Events

Dec. 2-5. American Society of Mechanical Engineers, Annual Meeting, Hotel Astor, New York.

Dec. 3. Los Angeles Rubber Group, Mayfair Hotel, Los Angeles, Cal.

Dec. 13. Boston Rubber Group, University Club, Boston, Mass.

Dec. 13. Detroit Rubber Group, Hotel Detroit-Leland, Detroit, Mich.

Dec. 17. Buffalo Rubber Group, Hotel Lenox, Buffalo, N. Y.

Dec. 20. New York Rubber Group, Building Trades Club, New York.

Jan. 6-10. S.A.E. Annual Meeting, Book-Cadillac Hotel, Detroit, Mich.

Apr. 7-11. American Chemical Society, 101st Meeting, St. Louis, Mo.

June 23-27. A.S.T.M. Annual Meeting, Palmer House, Chicago, Ill.

Sept. 8-12. American Chemical Society, 102nd Meeting, Atlantic City, N. J.

Detroit Meets on December 13

The annual Christmas meeting of the Detroit Group, Rubber Division, A.C.S., will be held at the Detroit-Leland Hotel in Detroit, Mich., on Friday, December 13. Although no speaker has as yet been selected, someone will talk on a general subject. Election of officers will also take place.

TALK AND MOVIE FEATURE LOS ANGELES GROUP MEETING

The presentation of a technical paper and the showing of a sound movie featured the November supper meeting of the Los Angeles Group, Rubber Division, A.C.S., held on Monday, November 4, in the Rainbow Room of the Hotel Mayfair in Los Angeles. Despite the fact that the meeting was held on election eve, and not on the regularly scheduled meeting night, which is the first Tuesday of the month, approximately 70 members and guests attended.

The technical paper, delivered by C. W. Wilson of the Research Department of the California Fruit Growers' Exchange, was on "Citrus Pectates: Their Properties, Manufacture and Uses." The value of the pectates, most of them made from the pulp, was discussed from a scientific angle in relation to various industries, with emphasis placed on their potential use in the rubber field. The motion picture shown, "The Second World War," a picture made up of various scenes in the war and preliminary events leading up to it, was presented by Robert O'Neill.

Three boxes of apples, donated as door prizes by C. M. Reinke, of the firm of Reinke, Hiller and Amende, Inc., were won by J. W. Frasche (Goodrich), Monty Montgomery (Martin, Hoyt & Milne), and Paul Ritter (U. S. Rubber), respectively. The special prize, a radio donated by the R. T. Vanderbilt Co., through Vic Vodra, its Pacific Coast representative, went to Bill Haney (Kirkhill Rubber).

Before the meeting was concluded a nominating committee, consisting of Ed Royal, Art Kroeger and Charles Roese, was appointed to suggest a slate of officers for the 1940-41 season. A book autographed by all those present was given to Harold Rehfeld, of Goodrich, who is being transferred to the Akron factory of the company.

Xmas Party Set for December 20

The Annual Christmas Party of the New York Group, Rubber Division, A.C.S., will be held on Friday, December 20, at the Building Trades Club in New York City. In addition to the all-around good time for which these annual parties are noted, officers for the coming year will be elected. Several novelty motion pictures are also being arranged. Following the recent decision of the group's Executive Committee, tickets for the meeting will be sold at $2.50 each to members and $5.00 each to non-members and guests. No new memberships will be accepted after December 1. Tickets and reservations for the meeting should be made as early as possible with Peter P. Pinto, c/o RUBBER AGE, 250 West 57th Street, New York City, secretary-treasurer of the group.

SURVEY SHOWS RUBBER TRADE READY FOR DEFENSE MEASURES

How the domestic rubber industry is girding itself in building up the national defense was revealed last month in a nationwide survey showing how demands upon it are being met. The results of the survey were reported in a recent issue of *Automotive News*.

With manufacturers receiving increased orders from the preparedness program, it is forecast that by early next year the industry will be turning out defense products at the rate of $40,000,000 a year. Until now only a small part of the output has been for defense, the study shows.

Parts for Trucks Important

Motor trucks bought by the government will provide the largest single outlet during the coming months for rubber products. Contracts already have been awarded for more than $50,000,000 worth. This amount will be doubled or tripled during the coming year, it is believed. Contracts call for delivery of at least 25,000 trucks before the end of this year.

Army trucks have from 4 to 10 wheels each, requiring from 5 to 12 tires per unit, including spares. The cost of such tires and tubes will range from about $75 to $600 per truck, the average running between $100 and $200. This would represent 5 to 10 per cent of the total cost of the truck. On this basis, the prospective truck-buying program would require tires and tubes costing upwards of $10,000,000.

To meet the demands of the defense program, the industry already has taken steps to prevent a bottleneck. To provide insurance against curtailment in the supply of crude from producing areas, companies have pushed the development of synthetics. In cooperation with the government the manufacturers are also guarding against such an emergency by building up reserve stocks of crude in this country.

Commerce department figures show that the outstanding stock increase in the entire non-durable goods field has occurred in rubber products, this index moving up from 116.7 at the end of June to 120.5 at the beginning of last month. Expansion of raw material holdings was credited for more than one-half of the greatly increased inventories in this industry.

Airplanes Next Largest Item

Airplanes are expected to be the largest defense customer for rubber, after trucks. This demand is expected to run between $4,000,000 and $8,000,000 this year.

There will be numerous other rubber demands for the army, including garments, collapsible boats, barrage and observation balloons and, not the least interesting, rubber tracks for high speed tanks. One contract for more than $1,400,000 worth already has been let for these.

New Home for United Carbon

Reproduced above is the architect's sketch of the new home-office building now under construction in Charleston, West Virginia, for the United Carbon Co. Plans for the building, which will cost more than $500,000 and will be the finest and most modern structure in Charleston, were described in the October issue of RUBBER AGE.

United Carbon has also announced the construction of a new carbon black plant at Aransas Pass, Texas, near Corpus Christi. The new plant, which will utilize residue gas from the Natural Gasoline Corporation's 50,000,000 cubic feet gasoline plant located 2½ miles west of the plant site, will consist partly of new construction and partly of several of the company's present carbon black units moved from Borger, Texas, and Monroe, Louisiana. It is expected to be in operation shortly after the first of the year.

48-Ounce Duck Conveyor Belt

The first conveyor belt ever made of 48 oz. duck has been produced by the U. S. Rubber Company. Significantly, it is the largest single unit slope conveyor belt in the world. It is now in operation in the Fifth Vein Coal Co. of Harrisburg, Ill., where it was installed by the McNally-Pittsburgh Mfg. Corp. of Pittsburgh, Kansas, who supplied and erected this plant.

The belt is a 9-ply Matchless, 1,530 feet long and 54 inches wide, weighing 35,000 pounds net. It conveys 1,000 tons per hour run-of-mine-coal at a speed of 350 feet per minute from underground hopper and feeders which receive the coal from the mine cars in the coal seam and lifts it 206 feet—equal to the height of a 20-story building—to the preparation plant.

The 48-ounce fabric, it is said, provides all the advantages of the 42-ounce duck, which was also originated by the U. S. Rubber Company, and which, up to now, was the strongest duck used in conveyor belts.

NATIONAL COTTON COUNCIL PERFECTS NEW TIRE CORD

A new development in cotton processing which yields a stronger, more resistant, and longer-wearing cotton cord for use in high-speed and heavy-duty tires, was announced at Memphis, Tenn., last month by the National Cotton Council. The development, revealed in the recent filing of a patent application, is the result of three years of intensive study conducted by Dr. R. F. Nickerson at the Mellon Institute under the auspices of the Council.

According to the announcement, the Firestone Tire & Rubber Co. has worked in collaboration with the Institute scientists and has verified the laboratory findings. Firestone, it is stated, has built and tested tires containing cotton cord made by the new process. Indoor tire tests as well as actual road tests are said to have borne out the promise of the laboratory results.

The Cotton Research Foundation, a non-profit organization whose object is to promote the use of cotton, has announced that through its patent rights the processes will be made available to the whole tire industry after they have been fully worked out on a commercial scale. Any revenue gained from this source will be used to defray further research expenses.

Superior Tire Predicted

The new development in cotton cord is expected to yield a tire which will be superior to any available heretofore. The three-year study which resulted in these new processing methods was devoted to an analysis of the properties of single cotton fibers and of tire cords with a view to modifying the fibers to meet present day tire requirements. According to laboratory tests, cotton cords processed by these new methods have a very low sensitivity to heat and moisture, have a thirty-five per cent greater breaking strength, and nearly a three hundred per cent longer flexing life than the best conventional cord of the same gauge size.

The enhanced performance of tires made from the new cotton cord holds promise of defense against inroads by synthetic fibers. Since the tire industry is one of the largest present markets for cotton, it is an outlet that must be defended vigorously. In the new cotton cord, the high-polymer or long-chain nature of the basic cellulose molecules is unimpaired and, consequently, it is able to withstand the heat and shocks of heavy duty usage. The unaltered long-chain cellulose molecules prevent the plastic flow effects which result in tire growth and, also, lessen the danger from cord brittleness when the tire becomes hot and dehydrated.

The cost of processing cotton by the new methods will probably be low and it is expected that tires made from it will compare favorably in price with present cotton tires.

NAMES IN THE NEWS

ERVIN C. POPE has been elected vice-president of the Cleveland Liner & Manufacturing Co., Cleveland, Ohio, and has taken over the sales work of his late brother, EDWARD A. POPE. He is now out contacting the trade. F. A. POPE is president of the company.

G. M. NAYLOR, crude rubber buyer for the B. F. Goodrich Co., who has spent the last two years in Singapore, has returned to the company's headquarters at Akron.

HOWARD O. HUTCHENS has been placed in full charge of all operations at the Eau Claire, Wisconsin, plant of the U. S. Rubber Co. R. P. F. LIDDELL, who during the illness of R. W. HUTCHENS temporarily assumed the latter's duties as operations manager, has resumed his previous work for the parent concern.

B. F. MORRIS, vice-president of Thomas A. Edison, Inc., has been elected president of the Association of American Battery Manufacturers. He succeeds L. B. F. RAYCROFT, industrial relations manager of the Electric Storage Battery Co., who held the post for five years.

E. O. DENZLER, formerly associated with the Goodyear Rubber Sundries, Inc., at New Haven, Conn., as chief chemist, is now with the Tyer Rubber Co., Andover, Mass., as production manager.

B. M. TODD, affiliated with the Consolidated Products Co., dealers in second hand rubber and other machinery, for the past twenty-one years, was tendered a testimonial dinner at the Newark Athletic Club, Newark, N. J., on October 10 by his associates. A. M. KAHN, president of the company, made the principal address.

WILLIAM E. CROFUT, JR., son of the late WILLIAM E. CROFUT, has been elected to succeed him as president of the Forest City Rubber Co., of Cleveland, Ohio. He has also been elected president of the company's Canadian subsidiary, Comfort Products, Ltd.

C. S. REEVE, formerly manager of research and development for the Barrett Co., at Edgewater, N. J., is now located in New York City as technical adviser for that company.

E. E. LEGGE, formerly district director of research for the American Steel & Wire Co., at Worcester, Mass., is now assistant director of research for that company, located at the company's headquarters in Cleveland, Ohio.

Waldo Joins Columbia Alkali

Frank Waldo, who was a member of the firm of E. M. & F. Waldo, Inc., for eighteen years, and who recently has been secretary-treasurer of the Stevens Yarn Co., has joined the Technical Service Department of the Columbia Alkali Corp. in the capacity of market research specialist. Born at Sea Cliff, L. I., N. Y., Mr. Waldo attended Staten Island Academy and the Bordentown Military Institute. He has been active in rubber and paint circles for many years and his new post will enable him to renew friendships of many years standing.

DR. PER K. FROHLICH, Director, Chemical Laboratories, Standard Oil Development Co., Elizabeth, N. J., has been proposed as president-elect of the A.C.S. for 1942. R. H. GERKE, research chemist of the U. S. Rubber Co., at Passaic, N. J., and FOSTER D. SNELL, head of the consulting laboratory bearing his name in Brooklyn, N. Y., were both proposed as councilors-at-large.

FRANK T. TUCKER, manager of tire advertising for the B. F. Goodrich Co., since 1932, has been named director of advertising for that company. He succeeds P. C. HANDERSON who has resigned to engage in general advertising work.

Safety Officers Selected

Officers of the Rubber Section of the National Safety Council for 1940-41 are: *General Chairman,* Oliver Hopkins, U. S. Rubber Co., Providence; *Vice-Chairman,* Ralph Farnum, U. S. Rubber Co., Detroit; *Secretary,* D. G. Welch, Hewitt Rubber Corp., Buffalo. John L. Grider, American Hard Rubber Co., Butler, N. J., is the new *News Letter Editor,* while the following will act as chairmen of the various committees: *Health,* Dr. W. S. Ash (U. S. Rubber, Detroit); *Engineering,* D. G. Welch (Hewitt); *Membership,* K. C. Loomis (Ohio Rubber); *Publicity,* R. M. Weimer (Dayton Rubber); *Statistics,* G. E. Teal (U. S. Rubber, Naugatuck).

Following are the members at large: E. W. Beck (U. S. Rubber, N. Y.), R. A. Bullock (Corduroy Rubber), C. F. Horan (Hood), J. J. Loge (General Tire), J. E. Lovas (U. S. Rubber, Passaic), W. H. MacKay (Dunlop), U. L. Moler (Inland Div., General Motors), R. W. Morse (Firestone), Wm. Spanton (American Hard Rubber, Akron), C. W. Ufford (Ohio Rubber), and Paul Van Cleef (Van Cleef Bros.).

NEW DIVISION SET UP FOR LATIN-AMERICAN AGRICULTURE

Agricultural cooperation with the South and Central American republics will be furthered by a new division, to be known as the Division of Latin-American Agriculture, it was announced last month by the U. S. Department of Agriculture. The new division will be part of the Office of Foreign Agricultural Relations, of which Leslie A. Wheeler is director.

Under the general supervision of Assistant Director Earl N. Bressman, who until recently was scientific adviser to former Secretary of Agriculture Wallace, the division will coordinate all phases of the program for encouraging production of crops that complement those of the United States, and in particular rubber. Included in this program are field investigations of the Bureau of Plant Industry and other science bureaus and the interchange of agriculture experts and scientists between the Americas.

Professional personnel of the new division, which will also work with private concerns interested in the production of complementary farm products in the Americas and which will provide statistical and other data on these products, includes Edgar R. Burkland, formerly connected with rubber surveys of the Department of Commerce.

Overman Equipment on Auction Block

The complete machinery and equipment of the Overman Tire Co., Inc., at Belleville, N. J., will be offered piecemeal at a public auction scheduled to be held at the plant on Tuesday, November 19. Mills, tire building equipment, laboratory apparatus, machine shop equipment, motor generator sets, conveyors, and air compressors are some of the equipment which will be offered. The sale is in the hands of the Industrial Plants Corp., 90 West Broadway, New York City. Overman Tire was reorganized by Alex Kreger about two years ago. Following Mr. Kreger's death last March, it was decided to discontinue the manufacture of tires. All obligations of the new corporation are understood to have been fully met.

Goodyear Introduces Spectrafoam

Spectrafoam, a colorful latex product that is said to have extensive application possibilities in the fields of toys and novelty manufacture, has been introduced by the Goodyear Tire & Rubber Co., Akron. Spectrafoam is made of Goodyear's Airfoam, the latex foam sponge. It is available in practically every color of the rainbow. It is made in slabs 43x53 inches, untrimmed, and in ¼, ½, ⅜, ⅝, ¾ and one inch thicknesses, and is being sold by Goodyear for conversion into finished products.

PRIZE PAPERS AND BUTYL TALK FEATURE N. Y. GROUP MEETING

The meeting of the New York Group, Rubber Division, A.C.S., held on October 18 at the Building Trades Club in New York City, featured one of the fullest technical sessions yet presented by the group. The three winning papers in the 1940 Essay Contest sponsored by the group were presented, in addition to a paper and motion picture on "Butyl Rubber." A motion picture on neoprene and a clever after dinner speaker rounded out the program. More than 300 members and guests attended the technical session, held before dinner, while some 270 were present at dinner and stayed to enjoy the balance of the program.

Winners in the Essay Contest and titles of the papers follow: *First Prize,* John V. Weaver, Manhattan Rubber Mfg. Division, Raybestos-Manhattan, Inc., Passaic, N. J., for "Determination of Scorching of Rubber and Synthetic Compounds by Use of the Mooney Plastometer;" *Second Prize,* W. J. Potter, R. T. Vanderbilt Co., East Norwalk, Conn., for "Exposure Tests of Stretched Vulcanized Sheets from Milled Rubber and from Latex;" *Third Prize,* R. O. Babbit, R. T. Vanderbilt Co., East Norwalk, Conn., for "Some General Principles of Compounding Rubber Latex." Contest judges were Harry L. Fisher (U. S. Industrial Alcohol), Emil Schwartz (General Electric), and H. A. Wakefield (Bakelite). The first and third prize-winning papers are presented elsewhere in this issue.

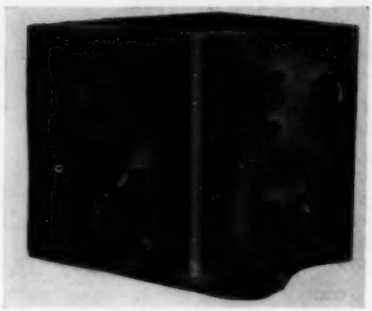
Abstract of Second Prize Paper

In Mr. Potter's paper, that awarded second prize, a comparison of the effects of continuously exposing stretched latex and milled rubber for 24 hours per day for seven days in the open air, for seven days in air in the absence of sunlight, and in ozone was made. From the comparison he drew five conclusions, as follows: (1) Latex rubber and milled rubber both have a "critical elongation" between 5 and 25%. (2) Latex rubber does not deteriorate for a given period of time so severely as milled rubber in outdoor and air exposure, but it is inferior in resistance to ozone at low elongations. (3) Increasing sulfur content results in poor aging on exposure to sunlight and ozone. (4) Ozone attacks rubber violently at low elongations, but it has a more nearly negligible effect at higher elongations. (5) In general, sunlight, air and ozone have a very similar effect on stretched and unstretched latex rubber and milled rubber.

The paper and motion picture on "Butyl Rubber," which was presented by Dr. Per K. Frolich, director, Chemical Division, Esso Laboratories, Standard Oil Development Co., were the same given before both the general meeting of the American Chemical Society and the meeting of the Rubber Division at Detroit recently. Dr. Frolich was subjected to numerous questions at the end of the presentation.

The film on neoprene, entitled "The Story of Neoprene—the Chemical Rubber," which was shown after dinner, was presented through the courtesy of the DuPont company. The film, introduced by V. A. Cosler of DuPont's Rubber Chemicals Division, was primarily made for the layman, but nevertheless was well received at the meeting. Two short cartoon films were also shown.

Self-Sealing Airplane Fuel Tank



Although virtually riddled with heavy machine gun bullets, the self-sealing fuel tank for airplanes shown above retained its full capacity of gasoline in recent tests conducted for the U. S. Navy by Firestone test engineers. As many as 52 machine gun bullets have been fired through a tank in test work without loss of gasoline. Cooperating in the National Defense Program, Firestone has developed these self-sealing tanks for use in armored motorized equipment and airplanes. A special lining material is the secret behind these special tanks.

A. Schrader's Son, Brooklyn, N. Y., has introduced a rubber-covered hose nozzle for either garden use or automobile washing. The rubber cover protects the nozzle from rough handling and prevents damage to polished surfaces. The flow is easily controlled from a fine mist to a solid stream with one hand.

A new Federal Specification for Pneumatic Automobile and Motorcycle Tires (ZZ-T-381c) has just been made available. The new specification, which was approved on March 22, becomes effective on November 15. Copies may be secured for 5 cents each from the Superintendent of Documents, Washington, D. C.

Goodrich has introduced "Texglue," a new cement with a latex base which is said to afford adhesive properties and excellent resistance to aging.

SYNTHETIC RUBBER IS THEME AT MEETING OF BOSTON GROUP

Approximately 200 members and guests, including a number from the Northeastern Section of the American Chemical Society, who were invited to participate, came to the October 24 meeting of the Boston Group, Rubber Division, A.C.S., held at the University Club, to hear a discussion on synthetic rubber by Dr. Per K. Frolich, director, Chemical Division, Esso Laboratories, Standard Oil Development Co. A dinner preceded the technical session.

Although Dr. Frolich was scheduled to deliver the same paper he had presented at both the general meeting of the A.C.S. and the meeting of the Rubber Division held in Detroit last September, as well as at the October 18 meeting of the New York Rubber Group, he deviated somewhat by limiting his coverage of "Butyl Rubber" to a motion picture and a few brief accompanying remarks, discussing only those synthetic rubbers which lend themselves to vulcanization.

Toward the conclusion of his address Dr. Frolich predicted that this country could, if necessary, be ready to produce a substantial portion of its rubber requirements synthetically in a period of two years. He emphasized the point that to produce a quantity of synthetic rubber equivalent to our present usage would require only 1/3% (on a weight basis) of our annual crude oil production.

It was announced that a combined Christmas Party and technical meeting would be held on December 13 at the University Club. Election of officers will also take place at this meeting. Emil Krismann (DuPont), G. W. Smith (Barrett) and R. J. Noble were named to the Nominating Committee to present a slate of officers.

Firestone has officially denied any present intentions of constructing a rubber factory in Springfield, Mass. The denial was prompted by the statement made by a political candidate in Massachusetts to the effect that the company was planning a factory in the Springfield-Holyoke area which would employ about 10,000.

Triangle Conduit and Cable Co., Inc., Elmhurst, L. I., N. Y., is understood to be planning an early move to a new factory in West Brunswick, N. J. The company has recently experienced labor troubles.

Original tire prices have been advanced from 9½ to 13%, retroactive to August 1. Advances in the costs of raw materials as well as increased manufacturing costs forced the advances. The new price scale will continue in effect until February 1, 1941. No change is contemplated in the price structure for replacement tires.

FINANCIAL NEWS

General Cable Corporation

First Nine Months: Net profit of $1,963,568, equal to 38c a common share, which compares with $44,135, or 29c a preferred share, in the corresponding period of the previous year. For the third quarter of the current year, the company reports net profit of $467,987, equal to 67c each on 306,689 shares of $4 Class A stock, which compares with 29c each on 664,558 shares of no-par common stock in the preceding quarter.

Rome Cable Corporation

Third Quarter: Net profit, subject to audit, of $100,755, equal to 53c each on 189,830 capital shares, which compares with $60,750, or 32c a share, in the second quarter, or 36c a share in the corresponding quarter of 1939. For the six months ended September 30, net profit amounted to $161,325, or 85c a share, against $115,083, or 60c a share, for the corresponding six months of 1939.

Boston Woven Hose & Rubber

Year Ended August 31: Net income of $281,796, equal to $2.75 each on 86,000 shares of common stock after providing dividends of $6.00 each on 7,500 shares of preferred stock. This compares with $220,350, or $2.04 per share of common, in the previous fiscal year. Total sales for the year amounted to $6,701,945, an increase of 19% over the $5,631,257 reported for the previous year.

Hewitt Rubber Corporation

First Nine Months: Net profit of $199,203, or $1.18 per share, which compares with $184,596, or $1.09 per share, in the corresponding period of 1939. For the third quarter of the current year, Hewitt reports net earnings of $96,832, equal to 57c per share on the capital stock outstanding, which compares with 38c per share earned in the three months ended June 30.

Baldwin Rubber Company

Third Quarter: Net profit of $81,475, equal to 26c a share on 315,754 shares of common stock, which compares with an indicated net profit of $28,723, or 9c a share, in the corresponding quarter of the previous year.

Anaconda Wire & Cable Co.

Third Quarter: Preliminary net income of $420,586, equal to $1.00 each on 421,981 shares of capital stock, which compares with $150,423, or 36c a share, for the corresponding quarter of the previous year.

Electric Hose & Rubber Co.

Year Ended August 31: Net income of $132,469, which compares with a net income of $91,820 reported for the preceding fiscal year. The company reports business as good, with early expansion planned.

Financial Briefs . . .

An interim consolidated income statement reveals that the American Cyanamid Company had a net income of $4,227,858 for the first nine months of 1940, equal to $1.61 a share on 2,618,364 common shares after dividend requirements on the preferred. This compares with $3,261,358, or $1.25 a share, in the 1939 period.

Monsanto Chemical Co. reports net income of $469,031 for the third quarter of 1940, equal to 28c a share on 1,241,694 shares of common stock, which compares with $1,192,219, or 85c a share, for the corresponding quarter of 1939. The report declares that the relatively low earnings for the 1940 quarter reflect the increased normal and excess profits taxes assessed under the Second Revenue Act of 1940.

Operations of the N. J. Zinc Co. for the nine months ended September 30 resulted in a net profit of $5,114,464, equal to $2.60 a share on 1,963,264 shares of capital stock, which compares with $3,507,939, or $1.78 a share, in the corresponding period of 1939.

The Flintkote Co. had a net income of $1,183,352, equal to $1.74 each on 678,546 shares of stock outstanding, for the forty weeks ended on October 5. This compares with $1,143,106, or $1.70 a share, in the corresponding period of the previous year.

Thermoid Co. reports a net profit, subject to audit, of $144,221, equal to 24c a share on 476,388 common shares, for the third quarter of the year. This compares with $75,555, or 9c a share, in the first nine months of 1939.

Schavoir Assets Sold at Auction

Assets of the Schavoir Rubber Co., Springdale, Conn., recently adjudged a bankrupt, were sold at public auction last month under the auspices of James J. Leon, Federal auctioneer, who maintains headquarters at 489 East Main Street, Bridgeport, Conn. Machinery and equipment, raw materials, finished goods, and other property, was disposed of during the sale.

ANOTHER ADDITION STARTED TO DUPONT'S NEOPRENE PLANT

In addition to the new unit now approaching completion, the Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., has started construction of a further enlargement of its neoprene plant at Deepwater, N. J. The added facilities are expected to be in operation by October, 1941, and will give the company a total capacity of 1,500,000 pounds of neoprene per month.

The new enlargement program is in line with DuPont's established policy of adding to neoprene production capacity in anticipation of the development of new uses. The demand for neoprene has been growing so rapidly in recent years that it has frequently been found necessary to start construction of a new unit while the previous one started was still under construction.

Slightly over a year ago, when DuPont was producing approximately 250,000 pounds a month and had another unit of equal size under construction, work was started on a further addition to bring total capacity to a million pounds a month. This step was taken none too soon, as recent events have proved. Now still further expansion is being undertaken so that the company may be ready to supply neoprene for new uses now under development when the demand arises.

Many of DuPont's customers, being fearful that the demand for neoprene may develop faster than can be foreseen, are availing themselves of the company's offer to accept contracts calling for specified quantities for delivery over a portion or all of the year 1941. Forward buying of this type also enables the company to more accurately forecast future demand and gauge its production accordingly.

Settle Strike at Marathon

The plant of the Marathon Rubber Products Co., at Wausau, Wisconsin, resumed operations on October 15, following a six-week strike, after a new contract was agreed upon between the management and Local 20617, an A. F. of L. affiliate. The union is believed to have secured slightly higher wage rates and seniority rights, while the contract prohibits strikes, lockouts or slow-downs during its life. Marathon is said to be working on rush orders on raincoats for the Army and Navy.

Private Sale of Rubber Machinery

The machinery and equipment of a large rubber factory, including mills, calenders, tubers, tire-building machines, vulcanizers, etc., is being offered for private sale rather than at public auction by Edward Shutz, P.O. Box 2471, Charlotte, N. C. The equipment can be inspected in Charlotte at any time. Mr. Shutz advises that he will not refuse any reasonable offer. Prices will be quoted on application.

LOS ANGELES NEWS

Jim Stull, until recently vice-president of the Santa Fe Rubber Mills, is now general manager of a new company known as the Golden West Rubber Mills, located at 8228 S. Central Avenue. A general line of mechanical rubber goods will be manufactured with tire retreading material as the main product. Associated with the new company is the V-Tire Clearing House, a firm that has been in business for some time. Mr. Stull has been in Los Angeles for several years and has been active in rubber manufacturing circles. Heyman Minkoff, president of the Santa Fe Rubber Mills, has assumed Mr. Stull's former duties in that company, for the time being at least.

Bill Haney of the Kirkhill Rubber Company has returned from Pulaski, Iowa, where he was called by the death of his father, O. W. Haney. Mr. Haney, Sr., had been ill for many months. He was 65 years old and had been postmaster in Pulaski for several years.

Carl J. Wright, vice-president and general manager of the General Atlas Carbon Company, New York City, spent several days in Los Angeles on business during October and early November. J. B. Preston, Jr., of the English Mica Company, New York City, also spent several days in Southern California during the same period.

Bob Abbott of the C. P. Hall Company of California recently spent several days in San Francisco on business.

Vic Vodra (Vanderbilt) recently made a trip to the laboratory in Connecticut and followed that up with a business contact trip through the Pacific Northwest on his way home to California.

Gene Sharpe of the Kirkhill Rubber Company has been off duty for some weeks following an operation for appendicitis.

Ross Morris, formerly chief compounder for Goodyear in the Los Angeles plant and later chief chemist for the Kelly-Springfield Tire Company, is again in California and is now at Mare Island working in the field of naval rubber development.

Karl Faulhaber, proprietor of the Faulhaber Rubber Company, 1346 East Slauson Avenue, has returned from a six weeks business and hunting trip in the Colorado area. He says he opened some splendid new accounts and in addition to that bagged a buck deer which he had transported to Los Angeles for festal purposes. Bill Stokes, the new sales manager for the company, reports business on the gain with the sales territory of his company rapidly being extended.

Charles Merralls, president of the Rubbercraft Corporation of California, Ltd., spent a large part of October and early November in New York City on business.

Mike Ryan, Goodyearite who has spent some time at the company's plant at Sao Paulo, Brazil, and who has now been transferred to Akron where he will figure in the development department, spent a few days in Los Angeles in October and while here took unto himself a wife, the former Miss Alice Salle of Glendale. Jack Lockridge, Pat Hogan, and Marty Riggs are other key men promoted or transferred during the month. Mr. Lockridge has been transferred to Akron where he will work chiefly on latex and adhesive research in the development department. Pat Hogan will spend several weeks in the Akron plant and later return to the Pacific Coast where he will be a contact man for Goodyear calling on airplane manufacturers. Marty Riggs has replaced Bob Gaylord as special field representative of the Akron development department with headquarters here. Mr. Gaylord is returning to Akron.

C. L. Remy, factory manager for the United States Rubber Company, has arrived home from an Eastern business trip.

A. C. Sprague, manager of the labor department for Goodrich at Akron, spent several days in Los Angeles in October visiting the local plant.

Carl E. Stentz, head of the Latex Seamless Products Company, reports business as good with a constantly enlarging field. Application of latex to wooden tanks, particularly to filter tanks, is offering a large new field, while application to steel tanks in various industrial plants is now offering another large volume of business.

Harold W. Rehfeld, who has been connected with the technical department of the B. F. Goodrich Company for two and a half years and who has taken an active part in the Los Angeles Rubber Group, has been transferred to Akron and was given an appreciative token of farewell at the November meeting of the group.

New Government Service Offered

The "Rubber News Letter" formerly issued by the Leather and Rubber Division of the Bureau of Foreign & Domestic Commerce, Washington, D. C., has been discontinued. The data formerly appearing in this "Letter" will in the future be found in the "Foreign Commerce Weekly" and in the "Industrial Reference Service," the latter a new type of service offered by the Government.

The "Industrial Reference Service" was inaugurated to provide business men more promptly and regularly with comprehensive current data that can be maintained for easy reference. It consists of a series of reports or parts, issued in 14 sections by commodity group. That covering rubber is known as "Part 10—Rubber and Its Products." The entire service of 14 parts is available at $15.00 per year. Single parts, such as rubber, are available at $1.00 per year, except Machinery and Foodstuffs which are $2.00 per year and Chemicals which is $4.00 per year.

Single copies of individual reports will be available at 10 cents each. Each report will be issued in standard format, paper size of 8½ x 11 inches, punched for a standard three-ring binder. Subscription remittances, by check or money order payable to the Bureau of Foreign & Domestic Commerce, should be forwarded to the Bureau at Washington, D. C. For those who wish further information concerning all of the 14 parts available in the new service, the Bureau has free literature available.

Arrange Industrial Conference

An Industrial Chemical Conference will be a feature of the National Chemical Exposition to be held December 11 through 15 at the Stevens Hotel in Chicago under the auspices of the Chicago Section of the American Chemical Society. An excellent program of papers in the nature of symposia on "Newer Developments in Chemistry and Chemical Engineering" has been arranged for this conference, sessions of which will be held on Thursday afternoon and evening, December 12; Friday forenoon, December 13, and Saturday afternoon, December 14. E. V. Murphree, vice-president in charge of research and development of the Standard Oil Development Co., will discuss "New Developments in Synthetic Chemicals and Materials in the Rubber Industry" at the Thursday forenoon session.

Avon Sole Co., Avon, Mass., has completed arrangements with Dr. Ray R. Reeves for the manufacture of Air Wedge Soles. Originally developed for one of the ranking tennis players in this country who was in need of arch support, the soles have since been adapted to a number of purposes. The soles have been made on the West Coast by Kirkhill Rubber Co.

OBITUARIES

Ernst A. Grenquist

Ernst A. Grenquist, research chemical engineer for the Celluloid Corporation, and formerly associated with the old Fisk Rubber Co., died at his home, 12 Appleton Road, Glen Ridge, N. J., on October 12, at the age of 41, after a short illness.

Born in Abo, Finland, Mr. Grenquist was educated at the Swedish Lyceum of Abo, the University of Helsingfors, and the University of Abo. Coming to the United States in 1924, he began his career as a chemist at the laboratories of the Highland Hospital in Rochester, N. Y. From 1926 to 1927 he was associated with the *Journal of the American Medical Association*. For three years following he was associated with Fisk, and in 1930 he joined the Celluloid Corporation where he was engaged in research and development work until his death.

Mr. Grenquist was the author of many published papers on such varied subjects as the dispersion of pigments in rubber, structural changes during the processing of rubber, chemistry of the white fir, cataphoresis of bacteria and cellulose acetate plastics. He was a member of the A.C.S. and an Associate Fellow of the British Institute of the Rubber Industry.

Funeral services were held in Bloomfield, N. J., on October 14, with interment in Bloomfield Cemetery. He leaves a widow and a son.

William E. Bruyn

William Edmund Bruyn, active for many years in the rubber importing business and a member of the board of governors of the Commodity Exchange, Inc., died at his home, 435 East 52nd St., New York City, on October 31, at the age of 61. Death was attributed to a heart attack.

Mr. Bruyn was born in Rosendale, N. Y., a descendant of Jacobus Bruyn, an early settler in Ulster County. He joined the rubber importing firm of Littlejohn & Co., in New York City, in 1905, and for many years was treasurer and a partner of that firm. He was on the board of governors of the old Rubber Exchange, and when this exchange was merged with others to form the present Commodity Exchange, he remained as a governor of the enlarged group.

Active in rubber importing circles, Mr. Bruyn was a director and a former president of the Rubber Trade Association of New York. He was also president of the Ulster County Holland Society and a member of the Metropolitan and India House clubs. He leaves a widow.

Charles B. Seger

Charles Bronson Seger, former president of the U. S. Rubber Co., and a widely known railroad executive before he assumed that post, died at his country home near Lynchburg, Virginia, on November 11 at the age of 73.

Mr. Seger began his career as an office boy with a branch of the Southern Pacific Railway in New Orleans, where he was born. His rise in the railroad field was meteoric and he became vice-president and comptroller of Union Pacific in 1913. Five years later he was named president of the system.

In March, 1917, Mr. Seger was elected a director of the U. S. Rubber Co. He became president of the company in December, 1918, and assumed the chairmanship in 1921 after the death of Col. S. P. Colt. He also was president of Dominion Rubber, the Canadian subsidiary, and was chairman of both parent concern and subsidiary until his retirement in 1929.

Mr. Seger was a member of the Academy of Political Science, the English-Speaking Union, the American Geographical Society, the Institute of Social Science, and the New York Chamber of Commerce. Funeral services were held on November 12. A son and a daughter survive.

Sir Herbert Wright

Sir Herbert Wright, British scientist and industrialist, identified with the interests of more than twenty-five rubber cultivating and manufacturing companies, died at his home, Chalfont St. Giles, Buckinghamshire, England, on October 28, after a long illness. He was 66 years of age.

After considerable experience at the Royal Botanical Gardens in Ceylon, Sir Herbert, who was knighted in 1930 for his services as Chairman of the Executive Council of the Imperial College of Science and Technology, of which he was also treasurer from 1931 to 1938, worked in Ceylon as a consulting economic botanist on rubber plantations. He later went into the rubber industry, where his interests soon were applied to the operation of a score of companies. He was a past chairman of the Rubber Growers Association. A widow, son and daughter survive.

Earl L. McKimm

Earl L. McKimm, president of the Metamora Rubber Co., was killed in a traffic accident when his car collided with a truck near Toledo, Ohio, on October 22. Mr. McKimm, who was 47 years of age, was dead on arrival at Toledo Hospital. Death was due to internal injuries.

A close friend of the late Knute Rockne, Mr. McKimm played football at Notre Dame with him before he was made coach at that university. He went to Toledo, Ohio, about 15 years ago where he organized the Reliable Rubber Co. A few years ago, Mr. McKimm organized the Pilgrim Rubber Works at Metamora, Ohio, later forming the Metamora Rubber Co.

Funeral services were held in Toledo on October 25, with interment in Calvary Cemetery. He leaves a widow, two sons and a daughter.

Form Special Defense Committee

Lucius D. Tompkins, Herbert E. Smith and Elmer Roberts, all three vice-presidents and directors of the United States Rubber Co., as well as members of its executive committee, have been appointed to act as a special National Defense Committee by the company to bring about "the fullest cooperation by our company with the U. S. Government in defense activities." The function of the committee, which is headed by Mr. Tompkins as chairman, will be to make available every resource of the company and to co-ordinate all departments so that the Army and Navy may call upon these resources at their full efficiency.

Plans Experimental Unit

The Phillips Petroleum Company is believed to be planning the construction of an experimental and commercial plant at its refinery in Borger, Texas, for the extraction of butadiene from butane gas. The new plant, it is said, will consist merely of an extraction tower and the entire cost will not exceed $100,000. In the event the Hydrocarbon Chemical & Rubber Company, recently organized by the Phillips company and the B. F. Goodrich Company, requires an additional plant for the manufacture of "Hycar," the name given to its synthetic rubber, it would probably be built at Borger near the extraction plant.

New Synthetic Rubber Plan

In a press conference held on October 17, Jesse H. Jones, Federal Loan Administrator, said that the recently-organized Defense Plants Corporation, set up by the Reconstruction Finance Corporation to aid in the defense program, probably would advance the money necessary for establishment of a plant to produce synthetic rubber. Mr. Jones said that while no definite conclusions have been reached concerning such a plant, he doubted whether any commercial organization would be willing to put up the money to build a plant and it probably would have to be constructed with Government funds.

CANADIAN NEWS

James I. Simpson, president of Dunlop Tire and Rubber Goods Company, Ltd., Toronto, has been appointed a director of Small Arms, Limited, a recently created company wholly owned by the Dominion government. The new company, which will manufacture rifles, is part of Canada's rapidly expanding program of industrial development to provide war needs. Construction has already been started on a $2,500,000 plant in the Toronto area.

A year of war has meant more pay to a majority of workers in the Canadian rubber industry, according to a survey made by the industrial relations section of the School of Commerce and Administration of Queen's University, Kingston. The survey covered eight major rubber companies of which four reported increases in general wages, five reported increases in group wages, and six reported increases in working hours.

Canadian Consolidated Felt Company, subsidiary of Dominion Rubber, surrendered its Federal charter at Ottawa late in October. Dominion has held majority control of the company for some years and last May secured full control. The plant is located at Kitchener and specializes in materials for Dominion's extensive boot and shoe factories.

Among contracts in excess of $5,000 granted by the War Supply Board, Ottawa, since September 21 are the following: September 21, Goodyear Tire and Rubber Company of Canada, $20,867, for airplane tires; Firestone Tire and Rubber Company of Canada, $7,312, for airplane tires; B. F. Goodrich Rubber Company, $6,176 for airplane equipment, and $6,152 for personal equipment. October 4: Dominion Rubber, $34,891, for clothing, $18,750 for personal equipment and $6,703 for land transport; Canada Wire, $9,545 for airplane equipment; and Goodrich, $18,750 for personal equipment. October 18: Dominion Rubber, $84,000 for clothing and $50,950 for personal equipment; Goodrich, $169,800 for personal equipment; Seiberling Rubber, $5,557 for personal equipment; Goodyear, $123,359 for land transport, and Dunlop, $24,587 for land transport.

More than twice as much crude rubber was imported into Canada in August than in the same month of 1939, according to the most recent figures released by the Dominion Bureau of Statistics. These show a total of 9,987,073 pounds imported for August of this year compared with 4,553,281 a year ago. This brings the total for the first eight months of 1940 to 62,022,360 pounds, an increase of 52.2% over the same period last year.

Canada Wire and Cable has declared another dividend of fifty cents a share on the class B stock, bringing 1940 payments on this class to a record level of $1.25 a share. The payment will be made December 15. Dividends on the class B stock were resumed in 1939 with two twenty-five cent payments after being interrupted since 1931. The regular class A dividend of $1 a share and the quarterly dividend of $1.62 on the preferred shares will also be paid December 15. The increase in dividend payments is in line with the much higher earnings of the company this year. In the first six months of 1940 estimated net profits were $380,000 compared with $154,838 for the corresponding period in 1939.

John A. Fraser, purchasing agent of Gutta Percha and Rubber, Ltd., Toronto, was one of eight Canadian businessmen from widely divergent fields who participated in a recent Canadian Broadcasting Corporation program designed to tell the world that imports from England, instead of being cut off, had in many cases increased since the war began. The network feature was aimed at enemy propaganda claiming that Britain's foreign trade has been cut off and her factories and industries shut down.

Although Canada's rubber supply is shipped from Singapore and his company also buys manufactured materials in Britain, particularly velveteen for use in ladies' shoes, the Gutta Percha company has not lost one shipment since the war began, Fraser stated. "Neither British industry nor the merchant marine of the Empire has let us down on a single order," he said.

Launch Cooperative Program

The Bureau of Ships of the Navy Department, Washington, D. C., is understood to have launched a cooperative program with the Rubber Manufacturers Association to obtain more comprehensive data on the correlation between accelerated aging and sunlight aging on various types of rubber and synthetic rubber compounds. The final results of this investigation are not anticipated for at least two years.

CHICAGO RUBBER GROUP HEARS DISCUSSION ON CARBON BLACK

A discussion on "Properties of Various Types of Carbon Black," delivered by Dr. Arthur W. Campbell, of the Commercial Solvents Co., Terre Haute, Indiana, was the feature of a meeting of the Chicago Group, Rubber Division, A.C.S., held at the Hotel Sherman in Chicago on October 18. Following the lead set by the New York Group, the technical portion of the meeting was held before dinner.

In his discussion, Dr. Campbell showed slides describing the various processes under which carbon blacks were made. He then proceeded to show how the physical properties of the different types of black differed and in what respects they were similar. After presenting the paper, Dr. Campbell was besieged with questions concerning the various chemical and physical properties of the blacks discussed.

After presentation of this paper, the group adjourned to the College Inn of the hotel where dinner was served and entertainment furnished by one of the leading "swing" bands of the country. The next meeting of the group will be the annual "Ladies' Night."

Canadian Group Hears Riesing

E. F. Riesing, of the engineering department of the Firestone Tire & Rubber Co., was scheduled to deliver an address on "The Use of Rubber for Vibration Dampening" at the November 12 meeting of the Rubber Section of the Canadian Chemical Association, at the University of Toronto. A complete report of this meeting will appear in the next issue. I. E. Lightbown, of the Standard Oil Development Co., is scheduled to discuss "Butyl Rubber" at the December meeting of the group, while R. L. Sibley, of the Rubber Service Department, Monsanto Chemical Co., will talk on "Reactions of Rubber —Possible Commercial Uses" at the January meeting. Dates for these two meetings have not yet been set.

R. M. A. Elects Directorate

At the annual meeting of the Rubber Manufacturers Association, held in New York City on October 17, F. L. Curtis, treasurer of Raybestos-Manhattan, Inc., and general manager of the Manhattan Rubber Mfg. Division, and John L. Collyer, president of the B. F. Goodrich Co., were elected directors for terms expiring in 1941 and 1942, respectively. The following were elected for terms expiring in 1943: G. B. Dryden (Dryden Rubber), E. V. Germaine (Dunlop), A. B. Newhall (Talon, Inc.), Wm. O'Neil (General Tire), and P. W. Litchfield (Goodyear). Mr. Newhall, formerly executive vice-president of Goodrich, and now associated with Talon, Inc., in a sales executive capacity, is still a director of Goodrich.

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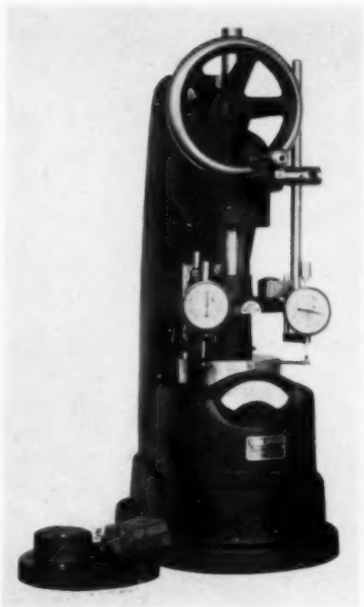
Stauffer CHEMICALS

NEW EQUIPMENT

Link Rubber Compression Tester

Especially developed for making compression tests of rubber samples, as well as of finished rubber products within its load range, a new type of Rubber Compression Tester has been made available by the Link Engineering and Manufacturing Co., 1048 W. Baltimore Ave., Detroit, Mich. Known as Model PR5-1000C, it has a capacity of 0 to 1,000 pounds. A quickly



interchangeable weighing unit of 0 to 500 pounds capacity, is available for use where the specified loads are such as to make the lower capacity desirable.

The new testing instrument is equipped with two dial indicators, that shown at the right of the accompanying illustration being of the 1-inch travel reverse-reading type, by means of which the thickness of the sample or the height of a product may be read directly to 0.001-inch, while the one at the left is a standard direct-reading type with 1-inch travel which also reads to 0.001-inch and shows the exact amount of deflection at various loads as they are applied. Both indicators are adjustable over a compression range of 4 inches.

The unit has an adjustable compression head assembly and may be used to test samples up to 9½ inches free height. The weighing table and compression head are 6 inches in diameter. The load dial of the 1,000-pound unit is graduated to 2 pounds, while that of the 500-pound unit is graduated to 1 pound. Load is applied by means of a hand wheel, but for light loads, up to 200 pounds, a lever may be used by disengaging the hand wheel. This is quickly accomplished by throwing a cam-lever.

The new compression tester may be obtained with a power-drive, geared down to give a ram travel of about 1 inch in 5 seconds to 1 inch in 10 seconds, as specified. A unit of this type is provided with an auto-

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Latex odor is not a pleasant one. Tell your customers that you have rid your products of this drawback. A clean, attractive odor can go a long way toward increasing sales.

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Height .....9"	Length .....9¾"	Range .....½"
Depth of Throat ....6½"	Dial 50 Divisions Each Div. 1/1000"	Weight .... 4 lbs. Frame . Aluminum

Designed for gauging stock as it is coming from the calender.

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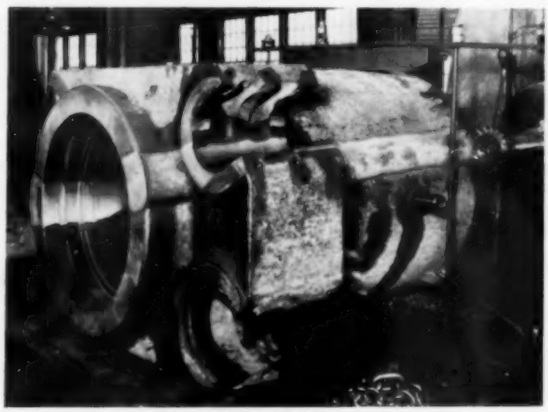
matic stop at pre-set compression height, and with safety over-travel stops at both top and bottom. Travel is controlled up and down by switches. For production testing, a power-driven unit with electronic control is available. This gives automatic indication by flash of neon lamps whenever a product comes within the specified limits for which it is pre-set. The new Link compression tester stands about 34 inches in height, has a base 12 inches wide and 19 inches long, and weighs approximately 175 pounds.

Thermit Welding Process

Production of an important item in a large rubber factory was cut in half recently when one of two large cast steel cylinders used in extruding lead casings on rubber hose and telephone cables failed. A prolonged



shut-down of equipment was avoided, however, by repairing the cylinder promptly with Thermit welding, a process of the Metal & Thermit Corp., 120 Broadway, New York City.

Weighing slightly more than 25 tons, the repaired cylinder is 77½ inches high, has an inside diameter of 30 inches, and a wall thickness ranging from 11 to 20 inches. The thickness through the base is 14 inches at the thinnest part. Fracture was complete, the cylinder breaking into two sections, one of which was slightly larger than the other. A 7-ton ram, which operated in the cylinder, stuck in the larger of the two broken pieces so tightly that when the ram was lifted by a crane it picked up the larger half of the cylinder, estimated to weigh about 14 tons, and would not clear itself. It was necessary to heat the wall of the cylinder to release the ram.

About one week was required to make the Thermit weld, including lining up of the parts, repairing the edges of the break, building the mold, preheating, pouring the Thermit steel and allowing the pieces to cool. 5,000 pounds of Thermit were used in making the repair and about 70 barrels of molding sand. The final step, which required more time than the welding, was the machining away of the collar of weld metal from the inside of the cylinder and from those portions of the outside where it would interfere with the fastening of the cylinder back in place in the extruding equipment.

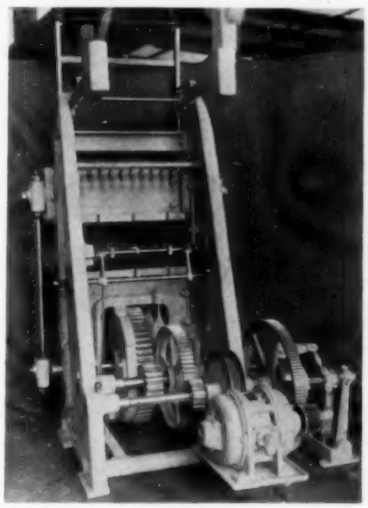
When the cylinder was returned to service, it was first tested at 2,000 pounds per square inch. As no leaks were found at this lower pressure, the full work-

ing load of 6,000 pounds per square inch was applied, and the cylinder has been operating 24 hours a day at this pressure for the past six months. The accompanying illustration shows the 25-ton cylinder repaired by Thermit welding, machined and ready to be replaced in service.

Wolcott-Ryder Ball Making Machine

A number of domestic and foreign factories are using the Wolcott-Ryder Rubber Ball Making Machine, a product of the Dutchess Tool Co., Beacon, N. Y. Although these machines were developed many years ago, to our knowledge no complete description of their operation has ever been published in the literature, and accordingly the accompanying illustration and the following method of operation, both supplied by the manufacturer, should prove of interest:

First, cut rubber in strips sufficiently wide to allow ¼-inch margin all around the outside of the cups; second, put piece of gum, to act as valve, on strip, to come about in center of each cup; third, place strip of rubber on table in front of ball machine, bring down ammonia box and jar a drop to match each cup; fourth, place sheet on lower dies and bring needles forward by foot treadle; fifth, place top sheet of rubber on lower one, and start machine. The upper head of the machine comes down sufficiently close to seal the rubber, at which time the balls are inflated automatically, and needles are withdrawn automatically. A final squeeze is then given by the dies, which dwell slightly, allowing the rubber to seal. The machine stops automatically at upper end of the stroke, and is ready to repeat the operation. Sixth, after taking from the machine, place balls in molds and vulcanize. The ammonia forms a gas, and helps inflate the balls while vulcanizing. Seventh, the balls are then inflated with air pressure, by means of a needle through gum valves, which seal themselves when needles are withdrawn.



The Wolcott-Ryder machine requires approximately 5 h.p. to drive and accomplishes about three complete operations per minute, although it is known to have achieved seven operations per minute. Speed of operation is largely dependent on the nature of the work involved.

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EASY TO USE. No preliminary preparation . . . Simply immerse dirty mold in Kelite Matrix Cleaner 12 to 24 hours, withdraw and rinse with water.

LASTS INDEFINITELY. Many constant users report active life of Kelite Matrix Cleaner from 2 to 5 months, *in daily use.*

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, and MARCH 3, 1933, of THE RUBBER AGE, published monthly at East Stroudsburg, Pa., for September 15, 1940.

State of New York }
County of New York } ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared Peter P. Pinto, who, having been duly sworn according to law, deposes and says that he is the Business Manager of The Rubber Age and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in Section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers, are:

Publisher, Palmerton Publishing Company, Inc., 250 W. 57th St., New York City; Editor, M. E. Lerner, 250 W. 57th St., New York City; Managing Editor, None; Business Manager, Peter P. Pinto, 250 W. 57th St., New York City.

2. That the owner is (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given):

Palmerton Publishing Company, Inc., 250 W. 57th St., New York City; P. L. Palmerton, 250 W. 57th St., New York City; Earl D. Osborn, 40 E. 36th St., New York City; Peter P. Pinto, 250 W. 57th St., New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holders appear upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest, direct or indirect, in the said stocks, bonds, or other securities than as so stated by him.

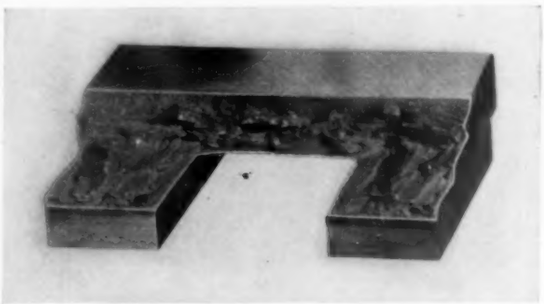
PETER P. PINTO, Business Manager.

Sworn to and subscribed before me this 18th day of September, 1940.

[SEAL] HANNAH GOLDENSON, Notary Public.
(My commission expires March 30th, 1942.)

Speed Case Steel Plate

Speed Case, the name given to the recently developed low carbon open hearth steel plate by W. J. Holliday & Co., Hammond, Indiana, is reported to be finding rapid application in the manufacture of compression or injection molds for plastics, rubber, fiber and other molding materials. One feature of this new steel is



that it machines without tearing and is usually machined without resorting to the use of cutting oils. The machined surface is said to be frequently so smooth that grinding or polishing is unnecessary. Because of its free machining qualities, tool life is greatly extended, regrinding being kept to a minimum. It can be machined at speeds up to 150 to 250 s.f.p.m.

Speed Case, which derives its name from the fact that it can be rapidly carburized, in 5 to 25% less time than steels of similar use, is said to be ductile, resistant to impact and abrasion, to have high shear and compression values and excellent physical properties with a tensile strength of 62,000 to 72,000 lbs./sq./in. Hot rolled Speed Case plate of 4-inch thickness shows a Brinell hardness of from 141 to 156. Its characteristics make it especially suitable for forging, cold forming, pressing, as well as machining. It can also readily be welded. A typical analysis of Speed Case reads as follows: carbon, .20; manganese, 1.25; sulfur, .250; phosphorus, .03 max.; silicon, .02 max.

The accompanying illustration shows a portion of Speed Case plate, broken to indicate depth of case and the tough fibrous core. The top shows the result of buffing after machining. No polishing was done, yet the surface is mirror-like, as though it were plated.

To facilitate thermocouple replacement, a **Universal Union for Angle-Type Couples** has been adopted by the Leeds & Northrup Co., Philadelphia, Penna. The two halves of this union fit snugly together in a ground joint, making it vapor and fume-tight.

•

The Type CF line of **inkless recorders** featured by the General Electric Co., Schenectady, N. Y., has been extended to include direct-current instruments available as voltmeters, ammeters, millivoltmeters, milliammeters, and even microammeters in ratings down to 125 microamperes, full scale. The new instruments are known as CF2 Models.

•

A new series of 128 models of **Interval Timers and Time Delay Relays** has been announced by the Paragon Electric Co., 37 W. Van Buren St., Chicago.

REVIEWS

BOOKS

Handbook for Chemical Patents. By Edward Thomas. Published by Chemical Publishing Co., Inc., 148 Lafayette St., New York City. 5½ x 8¼ in. 270 pp. $4.00.

In the belief that patent law which deals with the rights of inventors should be presented in a simple and interesting guise so that most people can grasp the important principles and that the typical chemist needed a brief book which would show him where the problems facing the chemical inventor lie and how those problems may be met, Edward Thomas authored the book, "The Law of Chemical Patents," which was published two years ago. That book summarized the patent law up to the middle of 1937.

But many changes have come into patent law in the last few years, partly through 800 citations of new decisions pertinent to chemical patents, and partly through amendments to the Patent Statute. To present the effect of these changes, both in statute and in attitudes of the courts, the present book summarizes the law presented in the earlier book, referring to the pages of that book for details and for citations of cases, and also presents the new phases of patent law in more detail. Thus, as the author points out in his preface, the present book is both a handbook for the general reader interested in chemical progress and a supplement to the earlier book to enable attorneys and others to locate rapidly any pertinent new cases on chemical inventions decided in the last two and one-half years.

The book is comprised of 23 chapters, and includes a Table of Cases, a Table of Citations of Law of Chemical Patents (from the earlier book), and a Subject Index. Several references to specific patents pertaining to rubber and the rubber industry are made.

•

A.S.T.M. Standards on Textile Materials. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Penna. 6 x 9 in. 380 pp. $2.00.

The sixty-five specifications of quality, tolerances, test procedures, and definitions developed by A.S.T.M. Committee D-13 on Textile Materials are included in this latest compilation, as well as three proposed methods which are published for general information. Also included are abstracts of papers presented at committee meetings, and valuable tables and data. Of the 65 standards given, 22 cover cotton products, including tests for hose and belt ducks and tire cord and fabrics. Photomicrographs of common textile fibers, a yarn number conversion table, a psychometric table for relative humidity, and a glossary of terms, including a section on defects in woven fabrics, are given in an Appendix. An Index of Methods of Test appears.

•

Collected Papers of Wallace H. Carothers on Polymerization. Edited by H. Mark and G. S. Whitby. Published by Interscience Publishers, Inc., 215 Fourth Ave., New York City. 6 x 9 in. 460 pp. $8.50.

This is the first of a series of monographs on the chemistry, physics and technology of high polymeric substances. The purpose of the series is to bring together present knowledge of the subject in a manner both comprehensive and critical. It is fitting that a collection of papers embodying the late Dr. Carothers' studies of high polymers and closely related matters should be selected as the first monograph in the series, since not only are these papers inspiring, but they point out many of the difficulties which work in this field is bound to meet. It was largely through Carothers' work in this field that the synthetic rubber industry in the U. S. was launched about ten years ago.

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Prices will be attractive; in fact, I will not refuse a reasonable offer. If you are interested in very modern rubber mill machinery and equipment, here is your opportunity of purchasing same. Some of the items in this plant are:

5—60 in. heavy duty Jumbo Mills in units of two and three with or without motor and drive;
1—Unit of two 50 in. mills with or without motor and drive;
1—66 in. 3-roll calender (complete unit);
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Synchronous Motor Driven Air Compressor;
Tire Building Machines, assorted, National and Akron Standard Mold;
All size Motors, synchronous, slip-ring, squirrel cage and D.C.
Tube Heaters of National and Akron Standard Mold Manufacture.

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REVIEWS (CONT'D)

The present book is divided into three parts, the first devoted to "Studies on Polymerization and Ring Formation," the second to "Acetylene Polymers and their Derivatives," and the third to a few other papers, mostly concerned with general discussions of the subject of polymerization. Developments leading to the introduction of Nylon are traced in Part One, while those concerned with the commercial introduction of neoprene appear in Part Two. The book contains a bibliography, a list of patents, and comprehensive author and subject indexes. The editors are to be complimented for a thorough job.

•

Handbook of Chemistry and Physics. (24th Edition). Edited by Charles D. Hodgman and Harry N. Holmes. Published by the Chemical Rubber Co., 1900 W. 112th St., Cleveland, Ohio. 4½ x 7 in. 2580 pp. $3.50.

The latest edition of this valuable handbook has been considerably enlarged. It is divided into five divisions, as follows: Mathematical Tables; Properties and Physical Constants; General Chemical Tables and Specific Gravity and Properties of Matter; Heat and Hygrometry, Sound, Electricity and Magnetism and Light; and Quantities and Units, Conversion Tables, and Miscellaneous Tables. For convenience, the divisions are separated by divisional guides, an outline of the contents of the section being printed on each guide.

Extensively revised, the new edition includes several new tables, including one on Physical Constants of Industrial Organic Compounds and one on Induced Radioactivities. The table on Physical Constants of Organic Compounds, which consists of 520 pages alone, has been changed from paragraph form to tabular arrangement. Cross references, introduced several editions back, have been retained. Extensive changes in available types of plastics and new information regarding their properties, made imperative a complete revision of this part of the Handbook. The new edition again satisfies the demand for an authoritative and comprehensive source of classified scientific data.

BOOKLETS, CATALOGS, Etc.

Survey of American Listed Corporations. (Supplement for 1939 to Tires and Other Rubber Products). Securities and Exchange Commission, Washington, D. C. 8½ x 11 in. 18 pp.

This supplement covers financial operations of 14 rubber manufacturers for fiscal years ending between July 1, 1939, and June 30, 1940. Financial data for the fiscal years 1934-1938 for all of the companies contained in the supplement, with the exception of two, were previously released as Report No. 9, Volume I, of the Survey of American Listed Corporations (see RUBBER AGE, May, 1940). Companies included in the supplement are Baldwin, Brown, Dayton, Firestone, General, Goodrich, Goodyear, Hewitt, Kleinert, Lee, Norwalk, Pharis, Seiberling, and U. S. Rubber. Data for the Faultless Rubber Co., which at the time of compilation had not yet filed its annual report for the fiscal year ended June 30, 1940, and the Samson Corporation, which was dissolved in 1939 and its assets acquired by U. S. Rubber, is not included.

•

Story of Speed Case. Speed Case Plate Division, W. J. Holliday & Co., Hammond, Indiana. 8½ x 11 in. 24 pp.

The free machining qualities of Speed Case, the recently developed low carbon open hearth steel plate, which finds particular application in the manufacture of molds for the rubber, plastic and other industries, are discussed in this new booklet. Data is given on the plate's characteristics, properties, shear and compression values, and other factors of importance. Methods of welding, and suggestions for the selection of the proper method, are included. The booklet is of interest not only to mold manufacturers but to the user of molds as well.

Chemical Engineering Catalog—1940. Published by the Reinhold Publishing Corp., 330 W. 42nd St., New York City. 8¼ x 11 in. 1098 pp.

This is the Twenty-Fifth Annual Edition of "The Process Industries' Catalog." It has been completely revised and brought up-to-date. Like previous editions, it is divided into four sections, *i.e.*, Trade Name Index; Equipment and Supplies; Chemicals and Raw Materials; and Technical Book Index and Catalog. The Equipment and Chemical sections are divided into two divisions each, one devoted to an index and the other to catalog data. The innovation introduced recently of permitting the inclusion of complete catalogs has been continued. The inclusion of certain useful nomographs and charts has also been continued, as has the separate indexing of laboratory and reagent chemicals in the Chemical Section.

•

Davison's Textile Blue Book: 1940. Published by the Davison Publishing Co., Ridgewood, N. J. 6½ x 9 in. 1374 pp. $7.50 (Office Edition).

This is the 75th year edition of this valuable guide to the textile industry. Completely revised, it reports all mills geographically and also separately by trades, and contains more than 4,000 classifications in the Buyers' Guide Section. Data is given on cotton, woolen, rayon, carpet and other types of mills, as well as on dyers, sanforizers, factors, cotton goods brokers, throwsters, etc. Over 8,000 textile plants in all are carefully reported on in detail. Arranged alphabetically by states and names, the companies are also classified by product of each mill. The directory is thumb indexed for quick reference to any section. Special sections of the directory may be purchased at special prices.

•

Zinc Oxide—A Product of Complex Physical and Chemical Properties. By Harlan A. Depew. American Zinc Sales Co., Columbus, Ohio. 6 x 9 in. 12 pp. (Reprint).

Reprinted from the August 15, 1940, issue of *Paint, Oil & Chemical Review*, this booklet outlines the differences in pigment zinc oxide, the significance of these differences, and some of the methods by which these differences can be controlled. The point is stressed that despite the complex physical and chemical properties of the material, the manufacturer of zinc oxide is still able to produce a pigment of special properties to fit both normal and unusual requirements. A complete bibliography is included.

•

Industry's Challenge to Research. Research Advisory Service, 51 East 42nd St., New York City. 8½ x 10¾ in. 48 pp.

More than 1,000 replies to the question, "What new product, process or material might industrial research develop that would be valuable to your industry?", were received in a recent study conducted by the Research Advisory Service, which is maintained as a voluntary aid to industry by a group of leading banks throughout the country. This report is a condensed version of these replies and may be called an informal blueprint for the research worker and the executive who makes the decision with regard to bringing out new products. Twelve developments suggested by rubber manufacturers are included.

•

Hills-McCanna Valves. (Catalog V-40). Hills-McCanna Co., 2349 Nelson St., Chicago, Ill. 8½ x 11 in. 16 pp.

The Saunders' Patent Valves manufactured by the company are both illustrated and described in this catalog. These valves, which have found wide application in the handling of latex, since the diaphragm used to effect closure also isolates the latex from the working parts of the bonnet, as well as for a wide variety of chemical service applications, are said to offer long life and low upkeep. Specifications are included as is a table of general service recommendations. Illustrations showing these valves in numerous applications are also shown.

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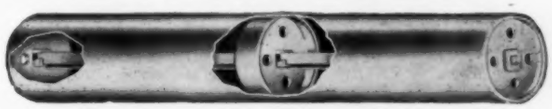

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, NOVEMBER 9, 1940

Crude Rubber

THE uncertain situation in the Far East, which resulted in cautious trading throughout the month of October, kept prices for spot on the Exchange fairly steady, unfavorable rumors causing the price to dip by several points, with favorable rumors bringing the price back again to a 20.50 level. Although the election results had very little effect on the market, the announcement on November 7 that the national debt may be considerably increased produced a 25 point rise, the price jumping from 20.50 on the previous day to 20.75. A rush of dealer buying on the following day, November 8, resulted in a 20.83 price. Then, following the stronger trend of the securities market, plus reported tightness in available shipping space from the Far East, the price moved into higher channels today (November 9), the quotation of 21.10 being high for the period. Low was 20.32 on October 16, which was touched again on October 29. Increased factory buying is reported in the actual market. Most of this, dealers hold, is covering against further price advances. Quotations in the outside market, Exchange, London and Singapore, follow:

As of November 9

Plantations—

Ribbed Smoked Sheets—

No. 1 Spot	—	@	.21⅜
January-March	—	@	.21
April-June	—	@	.20⅞
No. 2	—	@	.20¾
No. 3	—	@	.20⅝
No. 4	—	@	.2 3⅛
Thin Latex Crepe	—	@	.20⅞
Thick Latex Crepe	—	@	.21
Brown Crepe, No. 1	—	@	.19⅜
Brown Crepe, No. 2	—	@	.19¼
Amber Crepe, No. 2	—	@	.19⅜
Amber Crepe, No. 3	—	@	.19¼
Brown Crepe, Rolled	—	@	.15½

Latex—

Normal per lb., carload lots	—	@	.25⅜

Paras—

Up-River, fine	—	@	.17⅜
Acre Bolivian fine	—	@	.17½

Balata—

Brazilian block	—	@	.14

LONDON MARKET

Standard Smoked Sheets—Buyers—November 8

January	11⅛	@	12 1/16d
April-June	—	@	11 13/16d

SINGAPORE MARKET

Standard Smoked Sheets—Sellers—November 9

January-March	—	@	10 5/16d
April-June	—	@	10 3/16d

Scrap Rubber

Dealers report fairly active trading in practically all grades of scrap. Prices have risen sharply on auto tire peelings since our last report, and have dropped slightly on No. 2 inner tube grade. Supplies seem to be plentiful and no drastic changes are anticipated for the immediate future. Current quotations follow:

(Prices to Consumers)

Auto tire peelings	ton 25.00	@	27.00
Mixed auto	ton 14.00	@	15.00
Beadless tires	ton 18.00	@	19.00
Clean solid truck tires	ton 31.00	@	32.00
Boots and shoes	ton 24.00	@	25.00
Arctics, untrimmed	ton 18.00	@	19.00
Inner tubes, No. 1	lb. .10	@	.11
Inner tubes, No. 2	lb. .04½	@	.04¾
Inner tubes, Red	lb. .04½	@	.04¾

Reclaimed Rubber

The market for reclaim remains steady, with indications still pointing to increased demands due to general improvement in business conditions and the growing output of new car models. Consumption of reclaim in September amounted to 14,589 long tons, or 29.1% of the 50,206 long tons of crude rubber consumed. Reclaim consumption in August totaled 14,224 long tons. There has been no change in the price structure since our last report. Current quotations follow:

Shoe

Unwashed	lb. .06½	@	.06¾
Washed	lb. .10	@	.10⅛

Tube

No. 2 (Compounded)	lb. .09	@	.10
Red Tube	lb. .09	@	.09¼

Tires

Black (acid process)	lb. .07	@	.07¼
Black, selected tires	lb. .06	@	.06¼
Dark Gray	lb. .09¼	@	.10
White	lb. .12½	@	.14
Truck, Heavy Gravity	lb. .05½	@	.06
Truck, Light Gravity	lb. .07	@	.07½

Miscellaneous

Mechanical blends	lb. .04½	@	.05

Tire Fabrics

(Prices Net at the Mill)

Peeler, carded, 23/5/3	lb. .30	@	.30½
Peeler, carded, 23/4/3	lb. .31	@	.31¼
Peeler, carded, 15/3/3	lb. .28	@	.28¼
Peeler, carded, 15/4/2	lb. .28	@	.28¼
Peeler, carded 13/3/3	lb. .27	@	.27¼

CHAFERS

Carded, American, 1 3/16"	lb. .30	@	.30½
Carded, American, 1"	lb. .21¾	@	.29½

Cotton

After moving in a narrow range throughout October, the price for middling uplands on the Exchange started an upward movement early this month, culminating in a quotation of 9.92 today (November 9), high for the period. Low was 9.48 on October 14. The advance in the past few days resulted from several causes, most of them associated with the results of the election. First, the voting confirmed current Federal farm policies which require users of cotton to pay for their cotton in competition with loans. Second, it assured continued spending on the part of the Government in excess of receipts. In addition to these factors, the upward trend was also partly attributable to the expansion of activity in the cotton goods markets. Textile production is rising rapidly, having practically doubled in recent weeks. In view of the still greater production foreseen in cotton goods, largely due to Government orders, still higher prices are forecast for cotton. Quotations for middling uplands on the Exchange follow:

	Oct. 10	November 9		
	Close	High	Low	Close
December	9.49	9.95	9.88	9.90
March	9.44	9.95	9.85	9.91
May	9.31	9.91	9.82	9.86

Sheetings

48x40	36 in.	5.50	lb.	—	@	.04⅝
40x40	36 in.	6.15	lb.	—	@	.04⅛
40x36	36 in.	6.50	lb.	—	@	.04
48x48	40 in.	2.50	lb.	—	@	.08¼
48x48	40 in.	2.85	lb.	—	@	.07⅜
56x60	40 in.	3.60	lb.	—	@	.07½
48x44	40 in.	3.75	lb.	—	@	.06¼

Ducks

Enameling (single filling)	lb.	.25	@	.27
Belting and Hose	lb.	.26¾	@	—
Single filling, A grade	lb.	.11	@	.12
Double filling	lb.	.13	@	.14

Closing Rubber Prices on New York Commodity Exchange, Inc.

No. 1 Standard Contract of 10 Tons

FROM OCTOBER 11 TO NOVEMBER 9

Date	Spot	Oct.	Nov.	Dec.	Jan	Feb.	Mar.	Apr.	May	June	Sales
Oct. 11	20.37	20.37	20.34	20.32	20.17	20.01	19.85	19.75	19.67	——	132
12	——	——	——	——	——	——	——	——	——	——	—
13	——	——	——	——	——	——	——	——	——	——	—
14	20.62	20.56	20.53	20.50	20.33	20.19	20.04	19.97	19.91	——	68
15	20.56	20.50	20.45	20.40	20.20	20.05	19.90	19.82	19.74	——	53
16	20.32	20.30	20.25	20.20	20.00	19.84	19.66	19.60	19.52	——	55
17	20.50	20.49	20.44	20.39	20.18	20.07	19.97	19.90	19.84	——	28
18	20.38	20.41	20.36	20.31	20.10	20.00	19.90	19.83	19.77	——	28
19	20.38	20.38	20.33	20.28	20.10	20.00	19.90	19.80	19.70	——	22
20	——	——	——	——	——	——	——	——	——	——	—
21	20.43	20.40	20.35	20.30	20.15	20.06	19.98	19.89	19.81	——	9
22	20.50	20.48	20.45	20.42	20.20	20.10	20.00	19.90	19.80	——	42
23	20.50	20.47	20.43	20.40	20.20	20.11	20.02	19.95	19.88	——	23
24	20.50	20.50	20.40	20.35	20.15	20.06	19.96	19.90	19.84	——	56
25	20.50	20.45	20.42	20.40	20.20	20.06	19.93	19.84	19.75	——	9
26	20.38	20.35	20.32	20.30	20.10	20.02	19.94	19.84	19.75	——	55
27	——	——	——	——	——	——	——	——	——	——	—
28	20.38	20.35	20.32	20.30	20.05	19.96	19.88	19.83	19.79	——	58
29	20.32	——	20.32	20.27	20.02	19.92	19.83	19.78	19.74	——	57
30	20.50	——	20.33	20.30	20.05	19.97	19.90	19.83	19.77	——	22
31	20.62	——	20.50	20.45	20.20	20.10	20.00	19.93	19.87	——	29
Nov. 1	20.50	——	20.40	20.35	20.10	20.02	19.95	19.88	19.82	——	66
2	20.50	——	20.35	20.30	20.05	20.01	19.98	19.86	19.75	——	—
3	——	——	——	——	——	——	——	——	——	——	—
4	20.43	——	20.30	20.25	20.00	19.90	19.81	19.73	19.65	——	34
5	——	——	——	——	——	——	——	——	——	——	—
6	20.50	——	20.45	20.40	20.15	20.06	19.95	19.88	19.80	——	68
7	20.75	——	20.67	20.62	20.40	20.31	20.22	20.11	20.00	——	102
8	20.83	——	20.72	20.67	20.45	20.38	20.31	20.20	20.10	——	86
9	21.10	——	20.85	20.80	20.58	20.51	20.45	20.39	20.33	——	64

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WOOLWORTH BLDG. (TEL. CORTLAND 7-6920) NEW YORK, N.Y.

CHEMICAL MARKETS

New York, Nov. 12, 1940
All Prices F.O.B. Works

ACCELERATORS

Organic			
A-1 (Thiocarbanilid)	lb.	.24 @	.30
A-10	lb.	.31 @	.35
A-11	lb.	.52 @	.65
A-19	lb.	.52 @	.65
A-32	lb.	.70 @	.80
A-77	lb.	.42 @	.55
A-100	lb.	.42 @	.55
Aldehyde ammonia, crystals	lb.	.65 @	.70
Altax	lb.	.55 @	.60
Butyl Zimate	lb.	2.50 @	—
Captax	lb.	.50 @	.55
Crylene	lb.	.40 @	.47
Di-Ortho-Tolyguanidine	lb.	.44 @	.46
Diphenylguanidine	lb.	.35 @	.36
El-Sixty	lb.	.50 @	.65
Ethyl Zimate	lb.	2.50 @	—
Ethylidene aniline	lb.	.42 @	.43
Formaldehyde aniline	lb.	.31 @	—
Guantal	lb.	.40 @	.50
Hepteen	lb.	.35 @	.40
Hexamethylenetetramine	lb.	.33 @	—
Lead Oleate, No. 999	lb.	.13 @	—
Witco	lb.	.15 @	—
Monex	lb.	— @	2.35
Phenex	lb.	.50 @	.55
Pip-Pip	lb.	2.50 @	—
Pipsolene	lb.	1.55 @	1.85
R & H 50-D	lb.	.42 @	.43
R-2	lb.	1.40 @	1.80
R-2 Crystals	lb.	2.50 @	2.75
R-23	lb.	.40 @	—
RN-2	lb.	1.40 @	1.80
RN-2 Crystals	lb.	2.00 @	2.25
Rotax	lb.	.60 @	.65
Safex	lb.	1.20 @	1.30
SPDX	lb.	.70 @	.75
Super-Sulphur No. 1	lb.	.50 @	—
No. 2	lb.	.18 @	.25
Thiocarbanilid, drums	lb.	.24 @	.30
Thiurad	lb.	— @	2.35
Trimene	lb.	.55 @	.65
base	lb.	1.05 @	1.20
Triphenylguanidine	lb.	.45 @	—
Tuads	lb.	2.35 @	—
Ulto	lb.	1.25 @	1.75
Ureka	lb.	.60 @	.75
Blend B	lb.	.60 @	.75
Blend C	lb.	.56 @	.65
Vulcanex	lb.	.42 @	.43
Vulcanol	lb.	.85 @	—
Zimate	lb.	2.35 @	—
Inorganic			
Litharge, domestic	lb.	.07 @	.07½
Magnesia, calcined, heavy	lb.	.04 @	—

COLORS

Blacks (See Next Column)			
Blues			
Prussian	lb.	.33 @	.35
Ultramarine	lb.	.11 @	.16
Browns			
Mapico	lb.	.11 @	—
Umber, Turkey	lb.	.04¼ @	.05
Greens			
Chrome	lb.	.21 @	.30
Guignet's Green	lb.	.70 @	—
Reds			
Antimony crimson, 15/17	lb.	— @	—
sulfur, free	lb.	— @	—
Indian	lb.	.08¾ @	—
Domestic (Maroon)	lb.	.11 @	—
Mapico	lb.	.09¾ @	—
Red oxide, pure	lb.	.10 @	.12
Rub-Er-Red	lb.	.09¾ @	—
Whites			
Cryptone, No. 19	lb.	.05 @	.05¼
Cryptone CB, No. 21	lb.	.05 @	.05¼
Cryptone, ZS-230	lb.	.07½ @	.07¾
Cryptone, ZS-86	lb.	.07½ @	.07¾
Lithopone			
Albalith, black label-11	lb.	.0360 @	.0385
Azolith	lb.	.0360 @	.0385
Ray-bar	lb.	.05¼ @	.05¾
Ray-cal	lb.	.05¼ @	.05¾
Rayox	lb.	.13 @	—
Titanox A	lb.	.13 @	.13¾
Titanox B	lb.	.05¼ @	.05½
Titanox C	lb.	.05 @	.05¼
Zinc Oxide—American Process			
American Azo:			
ZZZ (lead free)	lb.	.06½ @	.06¾
Anaconda, lead free	lb.	.06½ @	.06¾
Horsehead Lead Free Brand:			
Special—3	lb.	.06½ @	.06¾
XX Red—4	lb.	.06½ @	.06¾
XX Red—72	lb.	.06½ @	.06¾
XX Red—78	lb.	.06½ @	.06¾
XX Red—103	lb.	.06½ @	.06¾
Kadox, black label—15	lb.	.06½ @	.06¾
Red label—17	lb.	.06½ @	.06¾
St. Joe, black label	lb.	.06¼ @	.06¾
green label	lb.	.06½ @	.06¾
red label	lb.	.06½ @	.06¾
U. S. P.—7, bbls.	lb.	.09½ @	.09¾
Zinc Oxide—French Process:			
Florence White Seal—7 bbls.	lb.	.08½ @	.08¾
Green seal—8	lb.	.08 @	.08¼
Red seal—9	lb.	.07½ @	.07¾
Yellows			
Cadmolith	lb.	.50 @	.55
Chrome	lb.	.13½ @	.15½
Mapico	lb.	.06¾ @	—

BLACKS
(In bags, carload lots)

Aerfloted Arrow	lb.	.02925 @	—
Certified	lb.	.02925 @	—
Certified Spheron	lb.	.02925 @	—
Continental	lb.	.02925 @	—
Disperso	lb.	.02925 @	—
Dixiedensed	lb.	.02925 @	—
Dixiedensed 66	lb.	.02925 @	—
Excello	lb.	.02925 @	—
Fumonex	lb.	.03 @	—
Fumonex Beads	lb.	.03 @	—
Gastex	lb.	.03 @	—
Kosmobile	lb.	.02925 @	—
Kosmobile 66	lb.	.02925 @	—
Micronex (Amarillo)	lb.	.02925 @	—
Micronex Beads (Amarillo)	lb.	.02925 @	—
Pelletex	lb.	.03 @	—
P-33	lb.	.0475 @	—
Supreme	lb.	.02925 @	—
Thermax	lb.	.02 @	—
Wyex	lb.	.02925 @	—

COMPOUNDING MATERIALS

Aluminum Flake	ton	21.85 @	24.50
Asbestine	ton	14.00 @	16.00
Barium carbonate (98-100%)	ton	47.00 @	49.00
Barytes	ton	22.85 @	—
Bentonite	ton	11.00 @	16.00
Blanc fixe, dry	ton	50.00 @	62.50
Calcene	ton	37.50 @	43.00
Catalpo (fact.)	lb.	.02 @	—
Chalk, precipitated			
Suprex white, extra lt.	ton	45.00 @	60.00
heavy	ton	45.00 @	55.00
Clay, Aerfloted, Suprex	ton	10.00 @	22.00
Crown (f.o.b. plant)	ton	10.00 @	—
Dixie	ton	10.00 @	22.50
Langford	ton	— @	8.50
McNamee	ton	10.00 @	22.50
Par	ton	10.00 @	22.50
Witco	ton	10.00 @	—
Cotton Flock (Dark)	lb.	.10½ @	.13
Kalite No. 1	ton	24.00 @	30.00
Kalite No. 3	ton	34.00 @	40.00
Kalvan	ton	95.00 @	121.00
Magnesium carbonate	lb.	.07½ @	.09½
Mica	ton	35.00 @	44.00
Mineralite	ton	— @	30.00
Pyrax A	ton	6.00 @	20.00
Rottenstone (powd. Dom.)	ton	25.50 @	37.50
Silene (calcium silicate)	lb.	.04 @	.045
Starch, powdered	cwt.	2.90 @	4.10
Talc, domestic	ton	17.00 @	25.00
Whiting, commercial	ton	16.00 @	26.00
Columbia Filler	ton	9.00 @	14.00
Witco	ton	6.00 @	—
Wood Flour	ton	24.00 @	25.00

MINERAL RUBBER

285°-300° Mineral Rubber	ton	23.00 @	42.00
Black Diamond	ton	25.00 @	—
Genasco, solid (factory)	ton	— @	—
Hard Hydrocarbon	ton	23.00 @	—
Parmr, solid	ton	— @	—
Pioneer, MR, solid	ton	— @	—

MISCELLANEOUS

Aromatics—Rodo #0	lb.	3.50 @	4.00
Rodo #10	lb.	4.50 @	5.00
Curodex 19	lb.	2.75 @	—
Curodex 188	lb.	3.50 @	—
Curodex 198	lb.	4.50 @	—
Para-Dors	lb.	4.50 @	—
Aresklene No. 375 (dispersing, wetting and penetrating agent)	lb.	.35 @	.50
Darvan (dispersing agent)	lb.	.30 @	.39
Santomerse S (dispersing, wetting, penetrating and stabilizing agent)	lb.	.11 @	.25
Sponge Paste	lb.	— @	.18
Sunproof	lb.	.22 @	.27
Tackol (tackifier)	lb.	.085 @	.18
Tonox	lb.	.52 @	.61
Ty-Ply R (and S)	gal.	6.75 @	10.75
Unicel (blowing agent)	lb.	.50 @	—

SOFTENERS

Acids			
Acetic, 28%, bbls.	100 lb.	2.23 @	2.48
Nitric, 36 degrees	cwt.	5.00 @	5.95
Acids, Fatty			
Laurex	lb.	.10½ @	.12¾
SL #10	lb.	.12 @	.14
Stearex Beads	lb.	.08 @	.09
Stearic, double pressed	lb.	.12½ @	.13½
Stearite	lb.	.08 @	—
Alkalies			
Caustic Soda, 76%	cwt.	2.30 @	3.55
Soda Ash, 58%	cwt.	1.10 @	2.93
Oils			
Cycline Oil	gal.	.14 @	.20
Degras, bbls.	lb.	.06 @	.06½
Fluxrite	lb.	.05½ @	.06½
Para-Flux	gal.	.08½ @	.18
Para-Lube	lb.	.425 @	.48
Petrolatum, amber	lb.	.02¾ @	.03¼
Pigmentaroil, tank cars	gal.	.16 @	—
in drums	gal.	.22½ @	.23½
Pine, steam distilled	gal.	.54 @	.59
Rosin Oil, cmpd.	gal.	.40 @	—
Rubberol	lb.	.13½ @	.14
Rubtack	lb.	.10 @	—
Seedine, c.l.	lb.	.07¼ @	—
Tackol	lb.	.08½ @	.18
Witco Palm Oil	lb.	— @	—
Witco Softener No. 20	gal.	.20 @	—
Woburn No. 8, c.l.	lb.	.06 @	—
Resins and Pitches			
Pitch, Burgundy	lb.	.05½ @	.06
coal tar	ton	19.00 @	22.00
hardwood	ton	16.00 @	22.50
pine, 200 lb. gr. wt.	bbl.	6.00 @	6.50
Pigmentar, tank cars	gal.	.16 @	—
in drums	gal.	.22½ @	.23½
R. S. L. Resin	lb.	— @	—
Retort Pine Tar, drums	ton	20.00 @	26.00
Solvents			
Acetone, pure	lb.	.05 @	.07
Benzene, 90%, tank car	gal.	.14 @	—
Beta-Trichlorethane	gal.	— @	.20
Bondogen	lb.	.98 @	1.25
Carbon, bisulfide	lb.	.05 @	.08½
Carbon tetrachloride	gal.	.66½ @	1.17
Dichlorethylene	lb.	— @	—
Dipentene, cml., drums	gal.	.38 @	.50
Ethylene dichloride	lb.	.06 @	.07½
Plastogen	lb.	.07¼ @	.12
Reogen (drums)	lb.	.11½ @	.26
Rub-Sol	gal.	.09½ @	—
Trichlorethylene	lb.	.08 @	.09½
Turpentine, spirits	gal.	.36 @	.40
dest. dist., drums	gal.	.21 @	.26
Waxes			
Beeswax, white	lb.	.35 @	.37
Carnauba, yellow	lb.	.71 @	.74
Ceresin, white, dom	lb.	.11½ @	—
Montan, crude	lb.	— @	—
Paraffin (c.l.—f.o.b. N. Y.)			
Yellow crude scale, 122/124	lb.	.02½ @	—
Refined, 123/125	lb.	.05¾ @	.06¼

ANTI-OXIDANTS

Agerite Alba	lb.	1.50 @	1.95
Exel	lb.	1.00 @	1.02
Gel	lb.	.57 @	.59
Hipar	lb.	.65 @	.67
Powder	lb.	.52 @	.54
Resin	lb.	.52 @	.54
Resin D	lb.	.52 @	.54
White	lb.	1.25 @	1.60
Albasan	lb.	.70 @	.75
Antox	lb.	— @	.56
B-L-E	lb.	.52 @	.65
Flectol B	lb.	.52 @	.65
Flectol H	lb.	.52 @	.65
Flectol White	lb.	.90 @	1.15
Neozone A, B, C, D, E	lb.	.52 @	.63
Oxynone	lb.	.64 @	.80
Retardex	lb.	.45 @	.48
Santoflex B	lb.	.52 @	.65
Santovar A	lb.	1.15 @	1.40
S.C.R.	lb.	.33 @	.35
Stabilite	lb.	.52 @	.54
Stabilite Alba	lb.	.70 @	.75
VGB	lb.	.52 @	.61

MOLD LUBRICANTS

Aresklene	lb.	.35 @	.50
Cocoa Soapstock	lb.	.06 @	.08
Dipex	lb.	.06 @	.08
Lubrex	lb.	.25 @	.30
Mineralite	ton	— @	30.00
Mold Paste	lb.	.12 @	.18
Rubberol	lb.	.13½ @	.14
Sericite	ton	65.00 @	75.00
Soap Tree Bark, cut, sifted	lb.	.06 @	.08

FACTICE OR RUBBER SUBSTITUTES

Amberex	lb.	.25 @	—
Amberex Type B	lb.	.18¾ @	—
Black	lb.	.08 @	.12
White	lb.	.08½ @	.13½
Brown	lb.	.08 @	.11½
Neophax A	lb.	.09 @	—

VULCANIZING INGREDIENTS

Dispersed Sulfur No. 2	lb.	.07½ @	.15
Sulfur Chloride, yellow (drs.)	lb.	.035 @	.04
Sulfur, rubber makers			
Refined (bags)	cwt.	2.35 @	2.70
Commercial (bags)	cwt.	2.00 @	2.35
Telloy	lb.	1.75 @	—
Vandex	lb.	1.75 @	—

STATISTICS

Crude Rubber — Latex & Guayule — Reclaim — Tires & Tubes — Automobiles — Rims — Gasoline — Cotton Prices

U. S. Imports and Exports of Crude Rubber

YEARS	Gross Imports: Long Tons	Gross Imports: Total Declared Value	Gross Imports: Average Declared Value per pound Cents	Re-exports: Long Tons	Re-exports: Total Declared Value	Re-exports: Average Declared Value per pound Cents	Net Imports: Long Tons
1924	325,899	173,367,272	23.75	10,309	6,057,637	26.23	315,590
1925	393,370	426,167,504	48.36	14,827	19,847,753	59.76	378,543
1926	409,944	501,131,064	54.57	17,671	22,470,583	56.77	392,273
1927	424,733	338,688,492	35.60	27,775	24,735,488	39.76	396,958
1928	432,633	242,727,423	25.05	32,159	18,128,761	25.17	400,474
1929	560,082	239,177,811	19.06	36,485	16,868,718	20.64	523,597
1930	482,083	139,133,048	12.88	30,205	9,310,205	13.76	451,878
1931	497,176	72,922,845	6.55	25,595	4,255,572	7.42	471,581
1932	409,556	31,936,459	3.48	20,930	2,015,612	4.30	388,626
1933	407,817	44,034,064	4.82	20,537	2,601,352	5.65	387,280
1934	449,513	97,929,676	9.73	23,848	5,770,109	10.80	425,665
1935	453,134	115,299,448	11.36	11,389	3,084,331	12.09	441,745
1936	467,064	152,072,496	14.54	12,581	4,488,223	15.93	454,483
1937	574,600	237,307,041	18.44	7,902	3,385,433	19.02	566,698
1938	397,620	125,357,730	14.07	5,652	1,799,124	14.21	391,968
1939	469,803	167,558,245	15.92	13,125	5,832,618	19.84	456,678
1939:							
Aug.	35,794	12,702,958	15.84	267	89,741	15.01	35,527
Sept.	35,006	12,667,740	16.16	1,472	659,055	19.98	33,534
Oct.	42,784	15,211,621	15.87	5,886	2,881,172	21.85	36,898
Nov.	39,422	14,555,150	16.48	1,228	539,763	19.63	38,194
Dec.	68,384	25,861,354	16.88	1,116	529,759	21.20	67,268
1940:							
Jan.	68,962	26,314,500	17.03	955	447,673	20.92	68,007
Feb.	40,603	15,578,517	17.13	1,291	599,819	20.74	39,312
Mar.	55,517	21,845,290	17.57	975	447,460	20.49	54,542
April	66,622	26,176,442	17.54	565	252,638	19.98	66,057
May	47,559	18,511,955	17.38	821	301,914	16.41	46,738
June	51,074	20,019,581	17.50	623	295,334	21.15	50,451
July	66,931	26,426,632	17.63	100	49,828	22.20	66,831
Aug.	70,453	27,608,883	17.49	416	183,369	19.69	70,037
Sept.	75,770	29,317,540	17.27	666	349,443	23.43	75,104

Note: "Gross Imports" do not include latex or guayule. To secure more accurate figures for "Net Imports" latex and guayule figures (shown below) should be added and the re-export figure deducted from the total. Annual figures for 1922, however, include both latex and guayule; guayule only is included in 1923. Annual figures for 1922-36 were revised in February, 1937.

United States Imports of Guayule, Balata, Jelutong, Liquid Latex

(All Quantities in Long Tons)

	Guayule Tons	Guayule Dollars	Balata Tons	Balata Dollars	Jelutong Tons	Jelutong Dollars	Liquid Latex (1) Tons	Liquid Latex (1) Dollars
1924	1,356	536,392	464	568,456	6,165	1,237,100	2,157	864,059
1925	3,781	1,803,448	517	574,750	6,749	1,642,531	3,272	3,537,510
1926	4,305	2,562,096	354	327,213	7,263	3,127,757	3,394	4,686,743
1927	5,018	2,674,957	582	477,246	7,785	2,448,657	1,495	1,170,650
1928	3,077	1,755,685	731	430,855	7,552	2,540,059	4,007	2,121,786
1929	1,275	545,175	728	566,964	8,204	2,458,126	3,729	1,788,391
1930	1,096	347,388	502	422,684	5,907	1,403,244	4,458	1,508,786
1931	....	.....	1,207	411,380	5,777	1,019,010	4,675	888,909
1932	....	.....	707	147,403	4,607	616,596	5,112	601,999
1933	....	.....	1,659	2,261,869	5,990	944,895	11,085	1,833,671
1934	398	75,349	1,054	438,209	4,987	943,752	13,107	3,643,221
1935	459	86,835	615	188,384	5,644	1,063,126	13,553	3,782,222
1936	1,229	286,552	535	199,368	6,163	1,296,364	19,852	6,659,899
1937	2,694	745,873	354	151,344	7,109	2,017,786	23,185	10,213,670
1938	2,485	623,819	509	181,140	9,132	2,944,504	11,878	4,147,318
1939	2,232	463,345	694	265,553	6,640	1,603,418	27,438	10,467,552
1939:								
Aug.	178	38,687	28	8,689	742	208,156	2,614	1,001,013
Sept.	133	30,091	36	19,682	479	100,285	2,525	965,615
Oct.	282	61,376	107	43,267	465	127,084	2,555	968,207
Nov.	214	46,558	96	37,858	289	74,358	3,071	1,227,788
Dec.	236	51,521	64	38,781	477	126,548	2,779	1,127,924
1940:								
Jan.	128	27,901	34	19,478	612	155,570	3,410	1,412,728
Feb.	314	70,251	55	26,420	461	134,878	2,171	947,524
Mar.	365	81,181	45	20,895	542	162,493	3,376	1,473,056
April	314	65,313	50	18,289	506	176,064	3,763	1,608,156
May	289	57,578	60	20,503	495	158,713	3,584	1,523,879
June	365	74,957	47	10,977	390	146,196	2,451	1,004,007
July	262	53,058	65	20,353	336	115,599	3,281	993,411
Aug.	297	59,464	61	22,638	701	276,642	2,278	1,022,531
Sept.	250	49,845	40	19,245	712	246,641	2,953	1,337,487

(1) Weight given in pounds of dry rubber contained in latex.
Note: Annual figures for 1924-1936 revised on basis of information received on February 8, 1937.

U. S. Consumption of Crude Rubber

(Including Latex)

Figures on Monthly Basis

	1933	1934	1935	1936	1937	1938	1939	1940
Jan.	22,645	39,190	46,636	48,631	50,879	31,265	47,387	54,978
Feb.	21,392	40,515	42,720	36,841	51,950	25,357	43,422	49,832
Mar.	17,843	47,003	42,153	42,813	54,129	32,389	51,416	50,192
Apr.	25,928	44,853	44,247	52,031	51,859	29,730	45,268	50,103
May	44,074	42,918	41,101	50,612	51,795	30,753	45,484	51,619
June	50,743	40,147	36,156	52,772	51,860	32,540	48,438	46,506
July	49,614	32,553	35,917	48,250	43,703	34,219	44,975	47,011
Aug.	44,428	33,216	38,775	46,777	41,506	40,552	51,740	50,234
Sept.	35,281	30,258	37,086	46,449	43,945	40,183	51,402	50,206
Oct.	31,543	31,253	41,969	49,637	38,754	42,850	57,155	.....
Nov.	28,831	34,748	42,310	50,433	34,025	49,050	55,677	.....
Dec.	28,757	36,569	42,474	49,754	29,195	48,143	49,636	.....
Tot.	401,079	453,223	491,544	575,000	543,600	437,031	592,000	.....

Note: The above figures are based on the annual surveys conducted by the Leather and Rubber Division, Bureau of Foreign & Domestic Commerce, Washington, D. C., with the exception of those for the current year which are estimates made by the Rubber Manufacturers Association. They are revised frequently and the latest available issue should always be consulted for the most reliable figures.

Reclaimed Rubber in the United States

(All Quantities in Long Tons)

Year	Production	Consumption Tons	Consumption % to Crude	Stocks	Year	Production	Consumption Tons	Consumption % to Crude	Stocks
1930	157,968	153,500	40.9	22,000	1935	122,948	117,523	23.9	17,000
1931	129,690	123,000	35.1	21,714	1936	150,571	141,486	24.6	19,000
1932	75,656	77,500	23.3	16,334	1937	185,033	162,000	29.8	28,800
1933	93,587	85,000	21.2	17,780	1938	122,400	120,800	29.9	23,000
1934	108,162	100,855	22.3	20,000	1939	186,000	170,000	28.7	25,250

Figures on Monthly Basis

1939									
Jan.	13,870	12,633	26.7	22,350	July	11,777	12,448	27.7	21,269
Feb.	13,193	12,269	28.3	22,644	Aug.	16,461	15,485	29.9	21,402
Mar.	14,638	14,888	29.0	21,638	Sep.	16,830	15,583	30.3	21,384
Apr.	13,591	12,309	27.2	22,172	Oct.	19,349	17,423	30.5	21,694
May	13,817	12,425	27.3	22,556	Nov.	19,417	16,551	29.7	23,239
June	14,848	13,669	28.2	22,976	Dec.	18,009	14,317	28.8	25,250
1940:									
Jan.	19,297	16,070	29.2	27,418	July	14,342	14,298	30.4	28,058
Feb.	17,992	15,370	30.8	28,603	Aug.	17,213	14,224	28.3	29,786
Mar.	17,234	15,931	31.7	28,488	Sep.	16,428	14,589	29.1	30,287
Apr.	16,568	16,298	32.5	27,558	Oct.	.....	.....	...	.....
May	17,552	15,719	30.5	28,397	Nov.	.....	.....	...	.....
June	16,631	15,844	34.1	28,327	Dec.	.....	.....	...	.....

Note: The above figures are based on the annual surveys conducted by the Leather and Rubber Division, Bureau of Foreign & Domestic Commerce, Washington, D. C., with the exception of those for the current year which are estimates made by the Rubber Manufacturers Association. They are revised frequently and the latest available issue should always be consulted for the most reliable figures. The annual figures are more accurate. Stocks shown are those on hand at the end of the indicated month or year.

U. S. Consumption of Gasoline

(Bureau of Mines Statistics)
(In Thousands of Barrels of 42 Gallons)

	1938	1939*	1940		1938	1939*	1940
January	35,323	38,089	40,370	August	50,549	54,025	55,346
February	31,981	34,928	37,557	September	46,150	49,505	52,297
March	41,409	43,042	44,607	October	46,365	49,854	.....
April	43,430	44,264	47,683	November	45,084	47,407	.....
May	44,937	49,766	52,946	December	41,742	43,807	.....
June	48,383	50,133	55,459				
July	47,650	50,689	53,865	Total	523,003	555,509	.....

* Revised.

Rims Inspected and Passed in U. S.

(Tire and Rim Association Reports)

	Total		Total		Total
1928	24,247,282	1932	6,261,336	1936	20,790,192
1929	24,141,502	1933	8,713,962	1937	22,257,964
1930	17,364,096	1934	12,255,118	1938	16,612,138
1931	11,253,800	1935	18,664,107	1939	17,471,914

1940		1940		1940	
January ...	2,163,914	May	1,743,786	September .	1,355,924
February ..	1,850,383	June	1,266,300	October ...	.....
March	1,918,241	July	825,089	November ..	.....
April	1,822,686	August	1,075,469	December ..	....

Daily Spot Closing Prices of Ribbed Smoked Sheet Rubber—*New York Market, in Cents per Pound*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave
1938																																
August	15⅛	15⅛	15⅛	15⅛	16	16⅛	16⅛	16⅛	16⅛	15⅝	15⅝	15⅝	—	—	15¾	15⅝	—	—	16⅛	—	—	16⅛	16⅛	16⅛	16⅛	—	15⅞	—	16⅛	16⅛	16⅛	16⅛
Sept.	—	16⅛	—	—	—	16⅛	17	16⅞	16⅞	—	17⅛	—	16⅞	—	15⅞	—	16⅛	—	16⅛	16⅛	16⅛	—	16⅛	—	16⅛	16⅛	16⅛	15⅞	16⅛	16⅛	—	16⅛
Oct.	16⅛	—	16⅛	16⅛	17	16⅛	—	17⅛	—	17⅛	—	—	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	—	16⅛	16⅛	16⅛	—	16⅛	—	16⅛	16⅛	16⅛	16⅛	—	16⅛	16⅛
Nov.	16⅛	16⅛	16⅛	16⅛	—	16⅛	16⅛	—	17⅛	16⅛	—	16⅛	—	16⅛	—	16⅛	—	16⅛	16⅛	—	15⅞	16⅛	—	16⅛	16⅛	15⅞	16⅛	16⅛	—	16⅛	16⅛	16⅛
Dec.	15⅞	15⅞	—	—	15⅞	15⅞	15⅞	15⅞	15⅞	16	—	15⅞	—	16	15⅞	16	—	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	—	—	—	16⅛	16⅛	16⅛	16⅛	16⅛	16
1939																																
Jan.	—	—	16⅛	16⅛	16	16	16	—	15⅞	16	15⅞	15⅞	15⅞	15⅞	—	15⅞	15⅞	15⅞	15⅞	15⅞	15⅞	—	15⅞	15⅞	15⅞	14⅞	15⅞	15⅞	—	15⅞	15⅞	15⅞
Feb.	15⅜	15⅜	15⅜	16⅛	—	—	—	15⅞	15⅞	—	—	—	—	16⅛	16⅛	16⅛	16⅛	16⅛	—	15⅜	15⅜	16⅛	16⅛	16⅛	16⅛	—	16⅛	16⅛	—	16⅛	16⅛	16⅛
March	—	16⅛	16⅛	15⅞	—	—	—	16⅛	16⅛	—	15⅞	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	15⅞	16⅛	15⅜	15⅜	15⅜	16⅛	16⅛	16⅛	16⅛	16⅛	15⅞	16	15⅞	15⅞	16⅛
April	15⅞	—	16	15⅞	16	16	—	16	16⅛	16	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	15⅞	16	15⅜	15⅜	15⅜	15⅞	15⅞	15⅞	15⅞	15⅞	15⅞	16	15⅞	15⅞	16⅛
May	15⅞	15⅞	15⅞	15⅞	16	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
June	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
July	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
August	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
September	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
October	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
November	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
December	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛	16⅛
1940																																
January	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	18⅞	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	18⅞	19⅛	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	19
February	18¾	18¾	18¾	18¾	18¾	18¾	18¾	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	19⅛	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞	18⅞
March	18¾	18¾	18¾	18½	18¾	18¾	18¾	18¾	18¾	18¾	18¾	18¾	18½	—	19	18⅞	19	18⅞	18½	20	20	20	20	20	20	20	20	20	20	20	20	20
April	18⅞	18⅞	18⅜	18⅜	18⅜	18⅞	19⅜	20	20½	18⅞	23½	23½	24	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½	23½
May	20	20	20	20½	20½	20½	20½	20½	20½	24	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½
June	21½	21½	21½	21½	21½	21½	21½	21½	21½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½	22½
July	21½	21½	21½	21½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½	20½
August	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜
September	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜
October	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜	19⅜
November	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛
December	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛	20⅛

Average Spot Closing Prices—Ribbed Smoked Sheets

(New York Markets)

Average Price per Pound for Years 1913-1932

Year	Cents	Year	Cents	Year	Cents	Year	Cents	Year	Cents
1913	82.04	1917	72.23	1921	16.36	1925	72.46	1929	20.59
1914	65.33	1918	60.15	1922	17.50	1926	48.50	1930	11.98
1915	65.85	1919	48.70	1923	29.45	1927	37.72	1931	6.17
1916	72.50	1920	36.30	1924	26.20	1928	22.48	1932	3.49

Average Monthly Price per Pound Since 1933

	1933 Cents	1934 Cents	1935 Cents	1936 Cents	1937 Cents	1938 Cents	1939 Cents	1940 Cents
Jan.	3.08	9.32	13.10	14.35	21.37	14.63	15.75	19.06
Feb.	2.95	10.45	12.92	15.48	21.33	14.71	15.93	18.83
Mar.	3.01	11.01	11.51	15.89	24.09	13.55	16.26	18.58
Apr.	3.56	12.10	11.55	15.98	23.44	11.84	15.87	19.16
May	4.95	13.26	12.05	15.62	21.14	11.57	16.07	21.21
June	6.15	13.51	12.57	15.85	19.29	12.57	16.37	22.20
July	8.01	14.60	12.10	16.49	18.86	15.37	16.51	21.12
Aug.	7.31	15.47	11.98	16.25	18.37	16.08	16.67	19.62
Sept.	7.30	15.36	11.55	16.46	18.55	16.15	21.24	19.28
Oct.	7.64	13.96	12.62	16.55	16.28	16.89	19.89	20.33
Nov.	8.66	13.04	13.15	17.97	14.60	16.24	20.21	
Dec.	8.87	12.98	13.28	20.01	15.41	16.05	20.01	
Average for Year	5.96	12.92	12.37	16.41	19.39	14.64	17.57	

London Closing Prices of Ribbed Smoked Sheets

(In Pence Per Pound)

Day	1940 Aug.	1940 Sept.	1940 Oct.	1940 Nov.	Day	1940 Aug.	1940 Sept.	1940 Oct.	1940 Nov.
1	13	—	11 11/32	11 11/32	17	—	12	11 3/4	
2	12 1/32	12 1/8	11 7/8	—	18	—	11 7/8	11 11/32	
3	—	12	11 7/8	—	19	13	11 11/32	—	
4	—	12 1/16	11 11/32	11 3/4	20	12 31/32	11 7/8	—	
5	12 1/32	12 5/8	—	11 11/32	21	12 3/4	—	11 3/4	
6	13 1/16	12 7/8	—	11 11/32	22	12 5/8	—	11 11/32	
7	13 1/8	—	11 11/32	11 11/32	23	12 5/8	11 7/8	11 7/8	
8	13	—	11 7/8	11 11/32	24	—	11 11/32	11 7/8	
9	13	12 1/16	11 7/8	—	25	—	11 3/4	11 11/32	
10	—	12 1/4	11 11/32	—	26	12 1/16	11 5/8	—	
11	—	12 1/8	11 11/32	—	27	12 1/2	11 7/8	—	
12	13 1/16	12 1/16	—	—	28	12 1/4	—	11 11/32	
13	13 1/8	12 1/16	—	—	29	12 1/4	—	11 3/4	
14	13 1/8	—	11 11/32	—	30	12 1/16	11 3/4	11 3/4	
15	13	—	11 11/32	—	31	—	—	11 3/4	
16	13	12	11 3/4	—					

Average Monthly Price Per Pound

Month	1937 Pence	1938 Pence	1939 Pence	1940 Pence	Month	1937 Pence	1938 Pence	1939 Pence	1940 Pence
Jan.	10.378	7.077	7.926	11.793	Aug.	8.830	7.841	8.545	12.818
Feb.	10.503	7.029	7.942	12.577	Sept.	8.935	7.918	9.634	11.964
Mar.	11.766	6.590	8.120	11.651	Oct.	7.855	8.355	10.177	11.813
Apr.	11.471	5.793	7.910	10.980	Nov.	7.080	8.111	11.210	
May	10.250	5.632	8.002	11.600	Dec.	7.332	8.005	11.559	
June	9.548	6.147	8.216	13.046	Average for Year.	9.424	7.164	8.959	
July	9.136	7.464	8.271	12.410					

Note: No quotations were made in the London market from June 17 through June 30. Accordingly, the average for the month is based on the first eleven trading days only.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market)

Recent Daily Price Per Pound

Date	1940 Sept.	1940 Oct.	1940 Nov.	Date	1940 Sept.	1940 Oct.	1940 Nov.	Date	1940 Sept.	1940 Oct.	1940 Nov.
1	—	9.69	9.57	11	9.63	9.55		22	—	9.56	
2	—	9.71	9.63	12	9.64	—		23	9.70	9.65	
3	9.78	9.71	—	13	9.62	—		24	9.73	9.65	
4	9.79	9.74	9.67	14	9.61	9.48		25	9.77	9.60	
5	9.78	9.75	—	15	—	9.52		26	9.84	9.59	
6	9.72	—	9.70	16	9.61	9.61		27	9.71	—	
7	9.57	9.72	9.84	17	9.61	9.60		28	9.77	9.55	
8	—	9.71	9.87	18	9.63	9.58		29	—	9.53	
9	9.64	9.67	9.92	19	9.65	9.57		30	9.69	9.58	
10	9.62	9.59	—	20	9.69	—		31	—	9.64	
				21	9.70	9.56					

Average Monthly Price Per Pound

	1937 Cents	1938 Cents	1939 Cents	1940 Cents		1937 Cents	1938 Cents	1939 Cents	1940 Cents
Jan.	13.06	8.57	8.94	11.19	Aug.	10.41	8.41	9.30	9.84
Feb.	13.15	8.91	8.97	11.10	Sept.	9.02	8.17	9.30	9.69
Mar.	14.46	8.92	9.00	10.90	Oct.	8.42	8.61	9.24	9.62
Apr.	14.23	8.76	8.87	10.89	Nov.	7.96	9.08	9.73	
May	13.34	8.50	9.56	10.33	Dec.	8.26	8.72	10.97	
June	12.70	8.38	9.88	10.72	Average for Year	11.44	8.66	9.46	
July	12.26	8.85	9.71	10.42					

Stocks of Crude Rubber

(All figures are in long tons)

ON HAND OR AFLOAT TO THE U. S.

End of:	ON HAND 1938	1939	1940	AFLOAT 1938	1939	1940	ON HAND AND AFLOAT 1938	1939	1940
Jan.	276,497	220,727	142,368	57,356	48,210	90,285	333,853	268,937	232,653
Feb.	292,067	207,882	134,328	47,459	55,814	112,257	339,526	263,696	246,585
Mar.	301,762	201,752	142,414	41,882	55,981	113,619	343,644	257,733	256,033
Apr.	303,901	188,074	162,459	39,071	57,918	102,557	342,972	245,992	265,016
May	300,907	187,980	161,446	32,859	54,046	109,364	333,766	242,026	270,810
June	294,796	173,493	168,235	32,079	51,274	119,138	326,875	224,767	287,373
July	282,785	165,450	190,222	40,400	52,990	139,629	323,185	218,440	329,851
Aug.	273,841	152,029	213,002	47,772	66,717	141,286	321,613	218,746	354,288
Sept.	268,094	136,824	241,358	48,927	68,310	137,033	317,021	205,134	378,391
Oct.	259,074	119,404		51,062	100,500		310,136	219,904	
Nov.	242,592	105,205		51,114	114,044		293,706	219,249	
Dec.	231,500	125,800		45,105	91,095		276,605	216,895	

STOCKS IN GREAT BRITAIN

(No. of Tons in Wharves and Warehouses, not including Latex)

At end of	London 1938	1939	1940	Liverpool 1938	1939	1940
January	40,203	51,420	12,000*	21,711	28,789	8,000*
February	46,596	48,312	10,000*	24,737	26,784	7,000*
March	50,233	46,768	10,000*	26,220	24,996	8,000*
April	54,296	44,760	12,000*	28,277	23,742	10,000*
May	57,194	43,454	12,000*	29,862	22,211	9,000*
June	60,307	42,374	11,000*	31,837	21,176	8,500*
July	62,236	37,772	15,500*	32,825	19,116	11,000*
August	65,113	28,363	20,000*	34,315	16,218	16,000*
September	63,321	24,965*		34,645	14,054*	
October	59,609	23,685*		33,483	13,336*	
November	57,794	23,244*		32,116	13,087*	
December	55,668	19,545*		31,012	11,006*	

* Estimated.

(Figures up to August, 1939, from the Rubber Trade Association of London)

STOCKS IN OTHER CENTRES

(Figures from Statistical Bulletin of the Int'l Rubber Regulation Committee)

	Penang and Singapore [1]	Malaya [2]	Ceylon [3]	Holland	Para and Manaos
At end of 1939					
May	20,849	52,837*	4,005	136	1,966
June	19,563*	55,834	3,771	101	1,821
July	27,042	55,948	4,217	188	1,474
August	20,543*	50,625	3,134	315	1,914
September	23,457*	52,755	2,742	...	2,682
October	25,376*	46,264	3,335	...	3,419
November	22,957*	45,133	5,289	...	4,510
December	15,299*	54,868	5,149	...	5,336
At end of 1940					
January	35,928	60,504	5,755	....	2,862
February	33,563*	52,615	4,452	....	2,869
March	23,830*	48,180	3,369	....	3,246
April	42,239	50,656	4,749	....	2,715
May	32,731*	45,715	3,774	....	1,743
June	32,411	45,618	5,057	....	1,706
July	36,750	43,850	4,392	....	1,667

[1] Dealers' and Port Stocks. [2] Inside Regulated Areas. [3] Dealers' Stocks Only. * Revised.

RUBBER STOCKS AFLOAT

End of:	Afloat for United States	Afloat for Europe	All Other * Afloat	Total * Afloat
1939				
August	66,717	30,000	23,283	120,000
September	68,310	30,000	35,690	134,000
October	100,500	35,000	37,500	173,000
November	114,044	35,000	21,956	171,000
December	91,095	35,000	25,905	152,000
1940				
January	90,285	40,000	44,715	175,000
February	112,257	40,000	40,743	193,000
March	113,619	45,000	52,381	211,000
April	102,557	45,000	40,443	188,000
May	109,364	45,000	55,636	210,000
June	119,138	50,000	65,862	235,000
July	139,629	55,000	55,371	250,000
August	141,286	55,000	53,714	250,000

* *Total afloat* is an arbitrary estimate based on number of months' shipments as adopted by the Department of Commerce. *All Other Afloat* is determined by subtracting the amount of stocks in transit to the United States and Europe from the estimated total.

TOTAL PRINCIPAL WORLD STOCKS

(Figures from the Survey of Current Business)

At End of:	1935	1936	1937*	1938*	1939	1940
January	698,153	600,479	454,249	549,762	497,665	433,841
February	686,195	599,355	445,265	565,833	479,578	429,551
March	678,809	583,318	447,856	586,666	460,723	447,472
April	677,006	567,172	428,249	586,291	438,252	465,345
May	677,569	541,871	413,134	568,158	429,979	470,981
June	671,525	520,255	434,250	573,136	407,640	500,774
July	679,061	519,074	445,782	580,654	418,639	547,708
August	680,644	500,520	457,462	565,394	397,345	579,119
September	661,509	493,585	470,768	551,447	396,867	.....
October	655,000	486,159	479,398	540,976	413,274	.....
November	617,300	466,491	493,266	512,196	395,217	.....
December	613,987	466,576	545,533	482,852	391,125	.....
Monthly Avge.	666,397	528,738	460,022	555,280	427,192	.....

* Revised.

U. S. Tire and Tube Statistics[1]

(All Figures Represent Thousands)

AUTOMOBILE CASINGS

Production Figures on Quarterly Basis

Quarter	1933	1934	1935	1936	1937	1938	1939	1940
Jan.-Mar.	6,635	13,437	13,355	11,376	15,565	7,314	13,946	14,849
Apr.-June	14,412	13,565	12,597	14,892	15,834	7,380	13,759	15,648
July-Sept.	14,707	9,822	11,312	14,914	13,207	10,794	15,182	13,745
Oct.-Dec.	9,550	10,406	12,099	14,858	9,704	12,360	14,726	.....
Total	45,304	47,230	49,363	56,040	53,310	37,848	57,613	.....

Shipment Figures on Quarterly Basis

Quarter	1933	1934	1935	1936	1937	1938	1939	1940
Jan.-Mar.	6,981	10,730	11,154	10,554	14,143	7,388	12,445	12,728
Apr.-June	15,139	14,998	13,473	15,940	15,741	9,564	15,107	17,449
July-Sept.	13,707	11,648	13,489	14,037	13,106	11,243	15,791	13,001
Oct.-Dec.	8,265	9,310	12,066	12,855	10,495	12,098	14,165	.....
Total	44,092	46,686	50,182	53,386	53,485	40,293	57,508	.....

Inventory Figures [2]

Quarter	1933	1934	1935	1936	1937	1938	1939	1940
Jan.-Mar.	7,290	11,651	11,675	8,762	12,004	10,547	9,963	10,747
Apr.-June	6,615	10,219	10,755	7,556	12,081	8,337	8,632	8,985
July-Sept.	7,595	8,419	8,288	8,690	11,200	7,859	8,080	9,886
Oct.-Dec.	8,888	9,455	8,196	10,717	10,383	8,166	8,665	.....

Figures for Recent Months

	PRODUCTION 1938	1939	1940	SHIPMENTS 1938	1939	1940	INVENTORY [2] 1938	1939	1940
July	3,346	4,595	4,707	3,907	5,143	4,315	8,041	8,103	9,299
Aug.	4,111	5,511	4,621	4,011	4,990	4,174	8,217	8,691	9,732
Sept.	3,986	5,076	4,417	3,938	5,658	4,512	8,022	8,080	9,886

AUTOMOBILE INNER TUBES

Production Figures on Quarterly Basis

Quarter	1933	1934	1935	1936	1937	1938	1939	1940
Jan.-Mar.	6,230	12,823	12,553	11,891	15,831	7,314	12,383	12,815
Apr.-June	13,001	13,191	11,631	14,624	15,413	7,380	11,847	13,704
July-Sept.	14,356	10,321	11,270	15,320	12,038	10,794	13,118	12,448
Oct.-Dec.	9,000	9,891	12,425	15,201	9,092	12,360	13,300	.....
Total	42,587	46,226	47,879	57,036	52,374	37,848	50,648	.....

Shipment Figures on Quarterly Basis

Quarter	1933	1934	1935	1936	1937	1938	1939	1940
Jan.-Mar.	6,539	10,640	11,252	11,367	14,606	7,387	11,422	11,684
Apr.-June	13,292	14,553	11,928	15,113	15,495	9,564	13,010	14,957
July-Sept.	13,370	11,545	13,251	15,069	12,901	11,243	13,449	11,363
Oct.-Dec.	8,189	8,306	11,636	12,874	9,765	12,099	13,309	.....
Total	41,390	45,044	48,067	54,423	52,767	40,293	51,190	.....

Inventory Figures [2]

Quarter	1933	1934	1935	1936	1937	1938	1939	1940
Jan.-Mar.	6,369	10,244	10,406	8,660	11,993	10,547	8,752	8,247
Apr.-June	6,097	8,795	10,050	8,075	11,833	8,337	7,549	6,914
July-Sept.	7,008	7,639	7,565	8,595	11,326	7,859	7,206	7,913
Oct.-Dec.	7,815	9,180	8,231	10,945	10,312	8,166	7,036	.....

Figures for Recent Months

	PRODUCTION 1938	1939	1940	SHIPMENTS 1938	1939	1940	INVENTORY [2] 1938	1939	1940
July	2,936	3,905	4,027	3,519	4,150	3,793	7,723	7,323	7,094
Aug.	4,026	4,757	4,314	3,744	4,309	3,600	8,029	7,799	7,803
Sept.	3,832	4,457	4,107	3,980	4,991	3,970	7,859	7,206	7,915

[1] These figures are based on reports received from the Rubber Manufacturers Association. They are revised frequently and the latest available issue should be consulted for most reliable figures.
[2] Stocks held by manufacturers at end of period indicated.

Automobile Production

Year	United States Total	Passenger Cars	Trucks	Canada Total	Passenger Cars	Trucks	Grand Total
1929	5,358,420	4,587,400	771,020	263,295	207,498	55,797	5,621,715
1930	3,355,986	2,814,452	540,534	154,192	125,442	28,750	3,510,178
1931	2,389,730	1,973,090	416,640	82,621	63,477	19,144	2,472,351
1932	1,370,678	1,135,493	235,187	60,816	50,718	10,098	1,431,494
1933	1,920,057	1,573,512	346,545	65,924	53,855	12,069	1,992,126
1934	2,753,111	2,177,919	575,192	116,852	92,647	24,205	2,869,963
1935	3,946,934	3,252,244	694,690	172,877	135,562	37,315	4,119,811
1936	4,454,115	3,669,528	784,587	162,159	128,369	33,790	4,616,274
1937	4,808,974	3,915,889	893,085	207,463	153,046	54,417	5,016,437
1938	2,489,085	2,000,985	488,100	166,086	123,761	42,325	2,655,171
1939*	3,577,292	2,866,796	710,496	155,316	108,806	46,510	3,732,608
1940							
Jan.*	432,279	362,897	69,382	17,213	12,579	4,634	449,492
Feb.*	404,032	337,756	66,276	18,193	12,779	5,414	422,225
Mar.*	423,620	352,922	70,698	16,612	12,025	4,587	440,232
Apr.	432,746	362,139	70,607	19,687	13,487	6,200	452,433
May	391,215	325,676	65,539	21,277	12,677	8,600	412,492
June	344,636	286,040	58,596	17,930	8,739	9,191	362,566
July	231,703	168,769	62,934	14,468	3,397	11,071	246,171
August	75,873	46,823	29,050	13,993	1,510	12,483	89,866
September	269,108	224,470	44,638	15,475	3,410	12,065	284,583

* Revised.
Note: U. S. figures represent factory sales; Canadian figures represent production.

ADVERTISING PAGES REMOVED

Exports of Crude Rubber from Principal Producing Countries

(Long Tons)

	BRITISH MALAYA[1]							NETHERLAND INDIES[4]							
	Gross Exports	Imports	Net Exports	Ceylon[2]	India & Burma[3]	Sarawak[3]	British North Borneo[3]	Thailand[3]	Java & Madura	Sumatra E. Coast	Other N. I.	Indo-China[3]	Amazon Valley	All Other[5]	World Total[6]
1923	252,016	70,432	181,584	39,971	6,416	5,703	4,237	1,718	32,930	46,344	57,822	5,067	16,765	7,856	406,415
1924	259,706	108,524	151,182	39,997	7,697	6,699	4,621	2,962	42,446	54,497	80,347	6,688	23,165	9,065	429,366
1925	316,825	158,022	158,803	49,566	10,082	5,424	5,377	5,377	46,757	65,499	120,626	7,881	25,298	13,797	514,487
1926	391,328	151,243	240,085	58,962	9,874	9,155	6,079	4,027	52,186	71,413	121,231	8,203	24,298	16,017	621,536
1927	371,322	182,845	188,477	55,356	11,321	10,923	6,582	5,472	55,297	77,815	142,171	8,645	28,782	15,633	606,474
1928	409,430	149,787	259,643	57,267	10,790	10,087	6,698	4,813	58,848	82,511	121,770	9,548	21,129	10,690	653,794
1929	374,836	163,092	411,744	81,584	11,663	11,077	7,381	5,018	65,990	87,789	134,037	9,696	21,148	6,767	853,894
1930	547,043	133,876	413,167	76,970	10,782	10,309	6,781	4,251	69,755	79,396	115,254	7,665	14,260	5,651	814,241
1931	519,740	125,506	394,234	61,769	8,470	10,451	6,247	4,218	75,952	87,747	116,009	11,696	12,121	3,292	792,203
1932	478,252	92,539	385,713	48,973	3,888	6,960	4,664	3,451	61,312	79,837	85,871	13,883	6,450	1,816	702,818
1933	573,412	167,377	406,035	63,351	4,527	10,874	7,555	7,765	73,851	91,861	149,659	18,394	9,883	2,737	846,312
1934	677,361	211,803	465,558	79,746	10,492	17,233	11,103	17,545	87,400	112,058	175,470	20,170	8,903	2,985	1,008,663
1935	590,319	174,652	415,667	54,316	13,968	19,465	8,885	28,327	57,488	78,325	139,297	28,816	11,275	8,745	864,574
1936	520,286	167,799	352,487	49,692	14,724	21,243	8,177	33,702	61,307	84,577	152,205	40,782	14,193	11,466	845,431
1937	681,638	213,446	468,192	70,353	17,015	25,922	13,213	5,551	84,085	139,632	207,863	43,399	15,576	13,063	1,133,864
1938	526,911	156,101	370,810	49,528	15,178	17,792	9,512	41,080	57,526	94,501	145,909	58,518	14,618	12,920	887,892
1939	553,324	177,851	375,473	61,026	15,881	24,014	11,864	41,266	72,786	117,791	181,272	65,140	13,892	22,224	1,002,629
1939:															
May	42,214	12,697	29,517	2,805	1,670	1,649	558	2,782	4,105	8,168	12,155	4,585	874	1,672	70,540
June	31,541	9,567	21,974	3,708	1,435	1,157	332	1,748	5,839	8,846	12,824	4,030	591	1,825	64,309
July	45,962	20,052	25,910	5,019	1,285	3,092	1,603	5,599	5,229	11,020	19,431	3,367	1,019	1,804	84,378
Aug.	53,497	12,635	40,862	5,620	416	1,749	975	5,230	6,236	10,010	11,232	7,020	1,197	1,525	92,072
Sept.	45,094	18,302	26,792	6,064	780	1,932	429	4,670	5,168	10,278	22,270	5,943	1,131	1,832	87,289
Oct.	70,839	21,493	49,346	5,234	815	2,487	1,730	2,047	9,950	13,645	21,404	5,022	1,414	2,185	115,279
Nov.	49,276	13,657	35,619	4,405	819	2,023	1,322	1,428	5,827	10,239	14,163	6,540	1,055	2,191	85,631
Dec.	41,568	8,479	33,089	9,496	2,565	2,476	616	1,177	8,130	8,580	7,156	11,018	1,377	2,052	87,732
1940:															
Jan.	56,214	30,136	26,078	7,091	1,630	1,987	1,858	5,469	6,361	16,070	31,676	5,315	1,777	2,000*	107,212
Feb.	62,105	16,598	45,507	8,741	2,076	2,678	1,164	3,887	7,270	14,873	15,713	7,040	1,781	2,000*	112,376
Mar.	65,269	17,565	47,704	5,406	2,054	3,526	1,050	3,111	8,864	13,415	20,015	3,551	1,298	2,000*	111,994
Apr.	47,430	22,106	25,324	4,309	2,173	2,951	1,799	1,834	7,703	12,759	23,815	2,927	1,582	2,000*	89,206
May	74,682	16,946	57,736	7,274	2,229	2,696	1,370	2,582	8,416	11,904	20,009	4,578	3,413	2,000*	122,207
June	60,814	15,529	45,285	5,597	1,896	4,077	1,421	2,178	9,830	14,616	20,104	2,730	1,045	2,000*	110,779
July	70,360	27,625	42,735	7,580	1,567	2,494	1,767	4,253	4,023	26,598	5,672	4,000*	1,321	2,000*	128,010
Aug.	66,212	20,508	45,604	8,226	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....

All figures from January, 1934, onward are net exports shown on a "dry rubber" basis as calculated by the International Rubber Regulation Committee. (1) Prior to January, 1934, Malayan net exports cannot be taken as production, since imported rubber is largely wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex also is not included in the early years, which on a dry rubber basis was as follows: 1924—1,117 tons; 1925—3,618; 1926—3,263; 1927—2,439; 1928—2,247; 1929—3,574; 1930—2,750; 1931—1,940; 1932—5,193; 1933—10,470, and 1934—14,172 tons. (2) Ceylon Chamber of Commerce statistics until 1926; rubber exported as latex is not included—such shipments on a dry rubber basis were: 1923—18 tons; 1924—90; 1925—6; 1926—20; 1927—½; 1928—1; 1929—2; 1930—11; 1931—2; 1932—2; 1933—1, and 1934—6 tons. (3) Official statistics. (4) Exports from "Other N. I." are chiefly wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included in earlier years, which is as follows on a dry rubber basis: 1923—2,342 tons; 1924—1,008; 1925—2,239; 1926—44; 1927—84; 1928—1,395; 1929—437; 1930—2,744; 1931—3,874; 1932—3,488; 1933—5,260, and 1934—5,330 tons. (5) Calculated from official import statistics of principal consuming countries; also includes United States imports of guayule. (6) This total includes the third column for British Malaya and all other figures shown for other territories. (*) Figure is provisional.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE; THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

Net Imports of Crude Rubber into Principal Manufacturing Countries

(Long Tons)

	United States[1]	United Kingdom	France (h)	Germany	Canada (ac)	Japan (da)	Italy	Russia (ce)	Australia (cd)	Belgium (d)	Netherlands	Scandinavia (abcdf)	Spain (g)	Czechoslovakia (abcd)	World Total
1919	238,407	42,671	17,685	5,584	6,395	9,753	9,894	73	1,002	3,995	2,771	3,149	2,418	9	343,808
1920	249,530	56,844	13,885	11,890	11,746	5,297	6,123	62	1,815	3,840	5,510	2,292	2,008	567	371,409
1921	179,736	42,087	15,135	21,920	8,124	21,713	3,906	165	1,014	1,705	1,022	1,279	2,245	569	300,620
1922	296,594	11,724	24,352	27,546	9,207	15,934	6,430	2,493	2,643	172	—3,807	1,778	589	567	396,222
1923	301,527	12,700	27,392	18,519	13,277	15,372	8,489	2,986	1,649	2,184	792	2,528	630	1,128	409,173
1924	319,103	—11,550	30,446	22,727	14,299	19,571	8,764	2,346	3,124	2,688	—807	3,178	944	1,370	416,203
1925	385,596	4,061	32,956	33,937	19,683	11,117	11,412	7,088	4,757	2,930	875	3,149	1,155	1,558	520,274
1926	399,981	84,865	34,240	22,773	20,229	18,125	9,809	6,529	9,021	2,498	2,670	4,046	1,299	1,870	617,957
1927	403,472	60,249	34,271	38,892	26,405	20,521	11,381	12,018	9,490	6,482	636	4,224	2,055	2,672	632,768
1928	407,572	4,846	36,498	37,855	30,447	25,621	12,433	15,134	8,430	7,958	2,243	4,418	3,178	3,138	599,771
1929	528,608	122,675	55,093	49,275	35,453	34,284	17,169	11,774	15,886	9,445	3,022	6,440	864	4,650	894,638
1930	458,036	120,069	68,503	45,488	28,793	33,039	18,639	16,387	5,354	10,635	2,924	7,710	2,400	4,468	822,445
1931	475,993	86,170	46,466	39,688	25,261	43,483	10,149	30,671	7,649	11,009	2,220	6,360	2,605	7,717	794,641
1932	393,844	44,086	42,506	45,121	20,917	56,027	14,469	30,637	12,576	9,519	2,851	7,262	4,359	9,444	693,618
1933	398,365	73,335	61,953	54,120	19,332	66,831	19,341	29,830	13,534	11,166	1,243	7,831	5,520	10,402	772,803
1934	439,172	158,482	49,560	59,330	28,439	69,905	21,398	47,271	9,642	9,115	3,758	12,418	6,900	10,999	926,389
1935	455,758	128,829	51,450	62,899	26,870	57,567	21,880	37,572	9,978	7,593	4,068	11,878	8,140	11,245	895,727
1936	475,359	—2,591	57,032	71,794	27,871	61,223	16,534	30,967	14,109	9,648	2,888	11,236	6,668	8,772	791,510
1937	592,394	92,707	59,871	98,170	36,088	62,311	24,733	30,462	19,164	14,970	4,343	4,680	2,400	13,063	1,055,356
1938	406,343	133,079	59,660	90,200	25,696	45,836	28,170	25,650	11,944	11,309	5,092	16,034	2,400	9,936	871,349
1939:															
May	45,390	7,531	4,646	8,413	3,006	4,438	1,573	2,000*	1,188	792	518	1,654	200*	618	81,967
June	33,951	8,439	4,649	8,190	2,423	3,067	1,992	2,000*	1,308	621	672	2,703	200*	487	70,702
July	36,932	4,040	4,282	8,437	3,164	3,668	1,350	1,000*	1,422	859	565	824	200*	412	67,155
Aug.	38,319	2,044	4,000*	....	2,033	3,145	1,500*	2,000*	2,182	952	651	1,546	200*	400*	58,972
Sept.	36,197	4,406	4,000*	....	2,639	9,254	1,500*	2,000*	875	108	222	1,200*	200*	...	63,572
Oct.	39,735	8,530	5,000*	....	5,787	2,749	1,500*	2,000*	1,235	519	653	1,200*	200*	...	69,589
Nov.	41,478	10,500*	5,000*	....	1,709	5,104	1,500*	2,000*	1,200*	667	613	1,200*	200*	...	71,504
Dec.	70,302	5,200*	5,000*	....	3,025	3,961	1,500*	2,000*	1,200*	1,035	1,827	1,200*	200*	...	94,702
1940:															
Jan.	71,565	450	5,000*	....	5,047	4,540	1,500*	2,000*	1,200*	891	682	1,200*	200*	.....	.....
Feb.	41,797	7,500	5,000*	.....	3,508	5,241	....	.....	.....	694	495	1,200*	200*	.....	.....
Mar.	58,302	14,200	....	....	3,062	6,057	.....	.....	.....	.....	627	.....	.....	.....	.....
Apr.	70,135	16,400	....	....	3,096	....	....	.....	....	.....	.....	.....	.....	.....	.....
May	50,610	10,000	....	.....	3,108	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
June	53,266	9,500	....	...	1,062	....	....	.....	.....	.....	.....	.....	.....	.....	.....
July	69,374	19,500	....	....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....
Aug.	72,613	21,250	....	....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....

a—Including gutta percha. b—Including balata. c—Re-exports not deducted in monthly statistics. d—Including some scrap and reclaimed rubber. e—Official statistics of rubber imports by Soviet Russia. f—Including Norway, Sweden, Denmark and Finland. g—United Kingdom and French exports to Spain except in years prior to 1925. h—French imports have been reduced in order to eliminate imports of gutta percha and to reduce to basis of net weight. [1]—United States imports of guayule are included in this compilation. *—Figure is provisional; final figure will be shown when available.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE: THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.